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IMPROVING MOTOR-DRIVEN INSTALLATIONS.

Genuine opportunities for the establishment of economies may be found in many factory installations driven by electric motors placed in service in the earlier days of power-plant development and distribution. A survey of the power requirements of different departments in manufacturing establishments which have undergone a healthy growth in the past five or ten years will disclose much that is suggestive to the engineer. Under the usual conditions the electric-motor drive is figured with more or less care for the initial machinery layout, subsequent demands being satisfied by adding new motors from time to time as the number, location and size of machinery units change. The result is that, in too many instances, the original motors are left in service without much regard to their later load conditions.

A survey of a representative shop showed that it would be advantageous to replace the existing direct-current motors by three-phase induction motors, thus completely standardizing the motive power, and equipping all motors of the same size with the same pulley diameters, the speeds being the same in all such cases. It was found that the existing motors were underloaded. A twenty-horsepower motor was driving by shafting and belting an equipment of planers, lathes and saws having an average load of only 7.5 horsepower. The rearrangement desirable was to belt three-horsepower motors to a bench saw and to a band saw, with a five-horsepower motor for the planer drive, including a countershaft driving four lathes. With this arrangement usually but one motor would be in use at a time and the average load would not exceed two horsepower. Substantial savings in power were indicated by the brief investigation made, which also showed the advisability of replacing steam-driven air compressors by motor-operated outfits, and the installation of a compressor and receiving tank sufficient to enable six drills to be simultaneously operated, the receiver supplying air for occasional demands of short duration. The shop was equipped with about twenty air drills of 0.5 and 0.75-inch diameter, and some were hardly used at all, others being used for a few moments of the day only. The tests showed that a compressor having a capacity of about 180 cubic feet per minute, belt-driven by a thirty-five-horsepower motor, with automatic governor starting and stopping

it according to the tank conditions, would enable the establishment to do away with its wasteful steam-driven equipment which ran constantly. Throughout the shop as a whole, a number of forty-horsepower motors could be replaced by twenty-five and thirty-five-horsepower units, and the change was effected by running a temporary feeder to each department undergoing the transfer of motive power, without the least interruption of production conditions. In the pattern shop alone a continuous saving of four kilowatts was indicated by the use of two small motors with a combined rating of eight horsepower instead of an existing motor of twenty-horsepower rating.

THE NEW INVENTIONS OF TESLA.

The address made by Dr. Nikola Tesla before the New York Section of the National Electric Light Association this week, and reported upon other pages of this issue, is one which will attract great attention on account of the startling statements which were made by the speaker. Mr. Tesla has been working upon the inventions now announced for a number of years, and while it is impossible to estimate their importance until further details are made known, the claims made for transmitting energy and speech to great distances point to an epoch-making discovery.

The experiments made by Dr. Tesla upon high-frequency and high-potential currents about twenty years ago were most illuminating and opened a field of vast possibilities to both the scientist and the engineer—a field which is still being explored. His other discoveries have attracted considerable attention, and this latest announcement bids fair to prove the most important of all.

Aside from his work on electrical oscillations, Dr. Tesla has invented and constructed a prime mover for which remarkable results are claimed. This engine is said to deliver ten horsepower for each pound of weight, a ratio which will mean revolution in the fields of the automobile and the flying machine.

The scientific and technical world will eagerly await the further demonstration of all these possibilities, for their practical realization will mean a most important step forward in electrical and mechanical engineering.

SECRET WIRELESS TELEGRAPHY.

Interference in wireless messages has been sought for mainly by selective apparatus and tuning to adjust the sending and receiving apparatus for the same particular wavelength. While this method serves to eliminate considerable interference, it is powerless to prevent eavesdropping, since any one possessing a receiving apparatus can adjust it until it is also properly tuned, and intercept any message which is of sufficient strength to be appreciable.

Directive apparatus for both sending and receiving assists in decreasing interference and increasing privacy, since the possibility of eavesdropping is restricted to a particular zone. Its value is, however, mainly in reducing interference, and in strengthening the signals in the chosen direction, since secrecy which is only partial fails utterly of its purpose.

Entire secrecy seems possible at present only by using a private code of signals or sending a message in cipher, as is common in wire telegraphy. An ingenious method of applying a cipher code and combining it with automatic sending and receiving apparatus has been invented by an officer of the Norwegian Navy, Captain Hovland, and was described in a paper recently read at Berlin. The principle of the mechanism used is mentioned elsewhere in this issue. Since a keyboard of ordinary letters is operated in sending and the message is printed in ordinary letters when received, operation is extemely simple, and the translation into cipher and back is entirely automatic. Great possibilities seem ahead of such a system, and demonstrations of its practical working will be awaited with interest in this country.

DESIGNING HYDROELECTRIC PLANTS FOR ECONOMICAL SERVICE.

The uncertainties which surround many hydroelectric undertakings in comparison with the cut-and-dried development common to steam-plant practice are at once an inspiration and a curse to the designing engineer. Much that is picturesque and encouraging to the electrical industry is associated with the production and transmission of power from water falls, and for this reason even commonplace developments of streams are full of interest and suggestion. Under modern methods of engineering design and supervision, however, two fundamental objects may be seen in the exploitation of water power by responsible interests—the reduction of the investment to the lowest possible terms consistent with reliable service, and the establishment of a plant which shall be capable of operation for long periods with a highly efficient use of water and by a force of employees almost ridiculously small in comparison with the number of men needed in a steam plant of the same capacity.

Examination of hydroelectric plants of recent construction shows that economical operation is receiving much more attention than in the earlier days of such developments. The conservation of flowage is investigated with great care in most of these enterprises, since money once expended upon a hydroelectric development is absolutely and irretrievably gone into works so permanent in character that only the most powerful financial resources can afford to correct the mistakes of early promoters, and then only in the face of an unusually favorable market for power. Minimum first cost is of supreme importance, and the saving of money by utilizing a portion of the dam in low-head developments as a part of the power-house wall, or by turning the abutments to similar account is becoming more and more common. The use of short and straight penstocks,

the retention of old dam structures so far as practicable where established water powers are remodelled for electric generation, the installation of short draft tubes and minimizing of waste space in the power house are all receiving careful attention. The flexibility of electrical generation and transmission permit economies in design which would be impossible in developing a water power for mechanical service at the site only. In some cases where old mechanical water-power developments have been remodeled for electrical transmission, it has been found less expensive and practically as reliable to retain one or more of the old wheel sites, locating the corresponding generators close to the wheels and operating them from a central switchboard controlling the entire plant. Such units are almost always of relatively small capacity, but they are useful in handling light loads, and the sacrifice of efficiency due to the use of an old or small turbine may not be a serious matter if the amount of power developed at the unit is relatively inconsiderable in proportion to the capacity of the main units.

Economy of operation is also being sought by installing motor-driven exciters in addition to exciters directly operated by water power, the former being more efficient than the latter through sharing in the improved efficiency of the main wheels and generators, particularly at fractional loads. Particular attention is being paid to draft-tube curvature and to the shape of intake canals and forebays, since any losses on either side of the wheels, through water friction, reduce the amount of power which can be produced with a given expenditure of water. The time has passed when water power can be considered as costing nothing from what might be called the raw-material standpoint. Other economies in operation are being secured by designing the turbine and generator rooms for the most convenient inspection of machinery in operation, with the location of the controlling switchboard at a point where the operation of governors can be seen, and with the provision of mechanical methods, preferably motor-driven, of raising racks and head gates. The larger plants find an electric crane invaluable in reducing the cost of installation, if the equipment is assembled early enough, and at least a hand-operated crane is essential to good service even in plants of very moderate size.

The problem of direct or remote switchboard control must be settled upon the basis of local conditions, but in general it is safe to say that unless a plant is of large size and serves a load of great responsibility, the simplicity of direct control has much in its favor from the point of view of annual cost of operation. The question of station heating is one which deserves more consideration, and it appears that there is room for a wider use of electricity in this connection, possibly in the way of arranging for the heat dissipated in the field rheostats to be utilized on the switchboard gallery; or, if air-blast transformers are employed, by turning the discharge to account instead of employing a coal-fired plant. In large grain elevators electric heating of office and weighing sections has lately come into much favor, and it seems probable that a saving could be effected in hydroelectric plants if the whole question were considered more thoroughly. With modern direct-connected units well arranged, one or two men per shift can handle an installation rated at many thousand kilowatts, and the relation between the mechanical arrangement of hydroelectric stations and the annual labor cost is found to be remarkably close.

The efficiency of large steam turbines makes it necessary to push economies of design and operation to the limit in order for transmitted water power to compete on even terms with coal in a modern power market, especially when the transmission is over a long line.

SMOKE NO CRITERION OF INDUSTRY.

Despite the marked improvement that has taken place in boiler-furnace design and operation in the last score of years, there is still manifested in many quarters a tendency to regard the belching of dense, black smoke from chimneys as an evidence of great industrial activity. This is shown by the prominence given to smoking stacks in many perspective views of large industrial establishments. It is only too painfully evident that frequently such views are not photographic reproductions of the actual premises and, if they are, that they have been retouched to improve appearances. The sad thing is that in the retouching the artists (?) have generally made the chimneys worse offenders of anti-smoke laws than they actually are, for fear, no doubt, that a smokeless stack would be considered as a sign of an idle plant. It is high time that progressive manufacturers stop this apparent manifestation of a poorly conducted plant.

Another instance of serious misconception of this matter recently came to our notice. A booming city in the Southwest, in order to encourage the location of factories in its midst, adopted the slogan: "We're for smoke." Even though this may have been meant in the figurative sense, a more unfortunate choice could probably not have been made. Smoke is by no means a criterion of industrial activity. It is an evidence of poor equipment or careless operation and a mark of contempt for the rights of others. In a warm climate it is particularly objectionable. Moreover, in a section of the country like the Southwest, where little or no exhaust steam is needed for heating in winter, there is scarcely any reason for the installation of an isolated power plant in a factory. In any up-to-date establishment the machinery is bound to be electrically driven and therefore central-station power service is peculiarly fitted for keeping the investment cost of new factories to a minimum. The city in question should therefore adopt a new slogan and encourage the establishment of electrically driven factories for which no chimneys at all need be provided.

N. E. L. A. CONVENTION NEWS.

1912 CONVENTION TO BE AT SEATTLE.

The Executive Committee of the National Electric Light Association held on May 11, at New York, a final meeting before the coming convention. The report of the secretary showed a flourishing state of affairs. Over 1,800 new members were admitted since the last meeting, about two months ago, a net gain of over 1,600. The Association has about $40,000 in cash and securities and no outstanding debt. The membership at the present time has reached 8,100.

The special committee, of which Vice-President John F. Gilchrist is chairman, reported on its trip to the Pacific Coast to inspect the various cities and their facilities with regard to the proposed convention of 1912, and after hearing and discussing the report of the committee it was unanimously decided to hold the next convention at Seattle, probably about the beginning of June. It was stated that there is keen interest in the subject on the Pacific Coast and that the trip will undoubtedly result in a large increase in membership in that section and a deeper interest in the work of the Association.

E. J. Allegaert, on behalf of the Committee on Uniform Accounting, submitted a report in favor of a system of interchange of accounts among the member companies and the adoption of a standard set of forms adapted to the Association's Standard Classification of Accounts to be distributed to the members, and the advocacy of the adoption of the standard classification by public-service commissions that have not yet acted upon such a matter and where and when new public-service commissions are created.

With regard to the coming convention, it was stated that although the convention was three weeks off, the registration had already reached about 1,750, which would indicate an actual attendance of at least 3,500 to 4,000. Additional facilities for the meeting have been secured in the Engineering Building. On the ground floor the ingenious idea has been adopted of supplementing the foyer by inclosing the large driveway around the building, so that the members can sit and lounge in the open air. The three largest meeting rooms will be devoted to the regular sessions and on the floor above another meeting room has been appropriated as headquarters for the New England Section, the Eastern New York Section, the Pennsylvania Section, the Sons of Jove and any other affiliated or auxiliary body applying for such accommodations. The Exhibition Committee will also have its headquarters on this floor, as will the Subcommittee on Theaters, which will distribute the tickets for the three theaters which have been engaged for Thursday evening of convention week.

The public-policy meeting is to be held on Wednesday evening, May 31, at the New Theater, when Secretary Nagel will represent President Taft and deliver an address. The report will be presented by Past-President Samuel Insull of Chicago. This will also be a notable musical affair, as the fine orchestra of the New Theater and Dr. Elliott Schenck have been retained to perform a selection of the notable musical successes of the season.

It may be noted incidentally that instead of the proposed morning concert for the ladies, a performance is to be given during the week of the beautiful play "Pomander Walk," by a cast made up entirely of children.

The baseball game will take place on Wednesday afternoon at the baseball grounds in Brooklyn; the competing teams will be those of the Brooklyn and Philadelphia companies.

Rates in Toledo, Ohio.

The Toledo Railways & Light Company, reiterating its statement that it would not accept the terms of the new ordinance passed by the Toledo City Council, reducing the electric lighting rates from nine cents to seven cents and the minimum monthly charge from one dollar to fifty cents, has sent to all its customers a new schedule which it alleges complies with the provisions of the ordinance, except as to the method of making charges.

The company offers a rate of eight cents to all lighting customers agreeing to use not less than twenty kilowatt-hours per month. It also offers a rate of ten cents per month for each room (minimum, thirty cents) as a readiness-to-serve charge, plus a meter rate of eight cents per kilowatt-hour for the first ten kilowatt-hours (minimum, fifty cents) and six cents per kilowatt-hour in excess of that amount. Under either scheme a discount of one cent per kilowatt-hour is offered for payment of accounts within ten days.

The City Solicitor regards this as an evasion of the ordinance and will institute injunction proceedings to compel compliance.

The City Council has appropriated $8,000 to secure the services of an expert to determine the physical value of the company's property.

Bills which have been introduced in the Legislature to enable the city to own and operate street-car lines and to issue bonds for their construction have been defeated.

Annual Meeting of American Institute of Electrical Engineers—Election of Officers.

The annual meeting of the American Institute of Electrical Engineers was held in the Auditorium of the Engineering Societies Building, New York City, on Tuesday evening, May 16. The Board of Directors presented its report for the fiscal year ending April 30, 1911. The report included a detailed statement of the financial status of the Institute and gave a summary of the work accomplished by all the standing and special committees during the year. The result of the membership vote for officers was announced as follows:

President, Gano Dunn, Ampere, N. J.

Vice-Presidents, D. B. Rushmore, Schenectady, N. Y.; C. W. Stone, Schenectady, N. Y.; W. G. Carlton, New York, N. Y.

Managers, F. S. Hunting, Fort Wayne, Ind.; Farley Osgood, Newark, N. J.; N. W. Storer, Pittsburg, Pa.; W. S. Lee, Charlotte, N. C.

Treasurer, George A. Hamilton.

Secretary, Ralph W. Pope.

The main feature of the program for the evening consisted of the ceremonies in connection with the presentation of the Edison Medal to Frank J. Sprague.

Electrical Papers at Foundrymen's Convention.

Among the papers to be presented at the convention of the American Foundrymen's Association in Pittsburg, May 23 to 26, are the following: "The Practicability of the Induction Furnace for the Making of Steel Castings," by C. H. Von Baur; "The Electric Furnace for Steel Castings," by P. Heroult; "Electric Motor Drive for Foundries," by Brent Wiley; "The Application of Lifting Magnets for Foundry Work," by H. F. Stratton.

Gano Dunn.

The career of Gano Dunn presents a study of determined and conscientious effort. A clear-headed and active student, and a tireless worker, he has improved his opportunities so that in a comparatively brief span of time he has become chief engineer and an officer in one of our leading electrical manufactories. And it is not only as an engineer and a business man that Mr. Dunn has been eminently successful. Gifted with a delightful personality and an earnest desire to work in behalf of his fellow engineers, he has been entrusted with important committee work and rendered such excellent service in the various engineering and technical organizations with which he has been connected that he has now been made the recipient of a signal honor—elected to the presidency of the American Institute of Electrical Engineers.

Photo by The Misses Selby GANO DUNN,
President-Elect, American Institute of Electrical Engineers.

Gano Dunn was born in New York City in 1870. He graduated with the degree of Bachelor of Science from the College of the City of New York in 1889, and received the degree of Electrical Engineer at Columbia University in 1891. In 1897 the degree of Master of Science was conferred upon him by the College of the City of New York. During the six years of his college studies he was steadily employed as a Morse operator on the lines of the Western Union Telegraph Company. He entered the employ of the Crocker-Wheeler Company at Ampere, N. J., in 1891 to carry out experimental work. He soon became engineer, and is now chief engineer, vice-president and a director of this company. For many years he was actual or responsible designer of all the company's types of alternating-current and direct-current motors, generators, transformers and other electrical apparatus, and he has solved power application and distribution problems in a large number of plants representing each of the principal industries. He has been a constant attendant at the Institute meetings since 1886, becoming an associate member in 1891 and a full member in 1894. He was elected a manager in 1897 and again in 1902, and was vice-president in 1900-1902 and 1905-1907. He has been twice president of the New York Electrical Society and has contributed many valuable papers and reports upon various subjects.

He assisted in organizing the International Electrical Congress, at St. Louis, in 1904, and was secretary of the Section on Electric Lighting and Distribution. He has served on the American Committee of the International Electrotechnical Commission, has been a member of a great many Institute committees, and his engineering trips abroad have given him a considerable acquaintance among electrical engineers in Great Britain, Germany, Switzerland, Italy and Sweden. He is a member of the Franklin Institute, the New York Academy of Sciences, the American Association for the Advancement of Science, the Illuminating Engineering Society and the National Electric Light Association.

Mr. Dunn has a host of friends who will wish him well in his coming administration.

Secret Wireless Telegraphy.

A paper on secret wireless telegraphy was recently read in the Urania, Berlin, by Captain Hovland, of the Norwegian Navy, who described his system of cipher language combined with the rapidity of ordinary transmission. A report on the subject states that the transmitting apparatus resembles a typewriter, and the letters are formed by depression of keys. A definite number of contacts is closed for each letter by the pressure of the key, and a number of current impulses proceeds from the contacts. The characteristic of the Hovland system consists, however, in the circumstance that the apparatus can be disarranged by means of a special cryptographic contrivance, which is composed of several cipher disks, and which permits, as in the case of the secret lock of a safe, of a large number of cipher combinations. The disarrangement of the apparatus leads to the dispatch, not of the current impulses which actually correspond with the individual letters, but of other definite impulses according to the combination which may be chosen. It is, of course, necessary for the receiving station to set its cryptographic contrivance according to the same combination, and the current impulses received are then transformed automatically again into those which correspond with original letters. Foreign stations can intercept the messages, but are unable to read them. Even stations equipped with the Hovland apparatus are only able to decipher the messages if they are aware of the combination used or can find it out by trials, but this is declared to be practically impossible owing to the existence of 720 possible combinations. The letters in the case of the latest apparatus are at once printed in type on paper strip. The system is to be introduced in the Norwegian Navy.—*Electrical Review* (London).

The next Congress of the International Association of Refrigeration will be held in Chicago, Ill., in 1913.

Presentation of Medal to Professor Arrhenius.

The Chicago Section of the American Chemical Society gave on May 12 a reception and dinner upon the occasion of the presentation of the first Willard Gibbs medal. The recipient of this medal was Svante Arrhenius, who first postulated the electrolytic theory of dissociation, as it is known at present. About 300 were present, many of the members bringing their wives.

Opening the address which followed the banquet, Harry Pratt Judson, president of the University of Chicago, spoke on "The International Bonds of Science," laying especial stress on the universal language of science and its tendency to bring all the peoples of the earth together. He mentioned the present event as a testimony of the tendency toward closer union through scientific bonds and especially spoke of Professor Arrhenius as a citizen of the "world of science."

S. T. Mather, chairman of the Chicago Section, outlined the life of the society and gave some idea of the means taken of choosing the recipient of the Willard Gibbs medal.

In presenting the medal, Prof. Alexander Smith, president of the society, spoke of the life of Doctor Arrhenius, dividing it into two periods, that before the presentation of his thesis containing the theory of electrolytic dissociation, and that after. In 1888, the year following the presentation of his paper, he published several other papers on the influence of the sun and moon on the earth's atmosphere. He wrote a number of books and contributed many valuable papers to astronomy and other branches of science. For these and other works of science the Nobel prize and many other honors have been awarded him.

His paper of 1884 was the first to present the theory of electrolytic dissociation, a theory which was not readily accepted, and was looked upon as a sort of heresy to science. On the intervention of Professor Ostwald, Arrhenius was later given the standing of a professor, and a paper read after that time elaborated the theory and carried more weight. After the collaboration of Ostwald, many more confirmations came until the theory gained general acceptance.

On formally presenting the medal to Professor Arrhenius, Professor Smith spoke of him as ranking with Gibbs and Faraday and said that the Chicago section was deeply honored to have him at its meeting.

After a brief speech of acceptance, Professor Arrhenius spoke on "Electrolytic Dissociation."

Financing Public Utilities.

Speaking on this subject at the May 10 meeting of the Chicago Electric Club, R. J. Graf, secretary and treasurer of H. M. Byllesby & Company, interestingly described the development of the financial phase of public utilities. Mr. Graf spoke of the difficulties that were encountered in the early days in obtaining sufficient capital to finance public utilities, particularly central stations. It was necessary to go to European countries, in many cases, to secure a market for bonds and today England and Contiental Europe contribute to a considerable extent to the finances of public-utility companies.

These conditions were contrasted to the conditions of today, electrical securities now being very easily marketed. Explaining the cause of this directly opposite attitude on the part of investors Mr. Graf stated that the permanency of the business, as evidenced by its present status contributed largely to the change. Also, the earnings of public utility companies have increased steadily and rapidly. In this connection the speaker mentioned a station in a town of 23,000 inhabitants which increased its net revenues 163 per cent in ten years. The personnel of the men in the electrical industry has been another feature which has aided the value of public utility securities.

In the course of his remarks Mr. Graf said that one of the chief influences against the marketing of public-utility securities was competition and he emphatically stated that public utilities should be operated as monopolies.

Harold Almert of H. M. Byllesby & Company, in the discussion recited an anecdote which emphasized the relative importance of the financial end of the business. He stated that public-utility securities were the best class on the market today.

Albert Scheible asked what the attitude of the local public was when a company's securities were sold to outside investors. Mr. Graf said that only in a few cases did local investors buy stock. Public-utility securities are handled by financial institutions, principally in the East, which have their established clientele. Brief remarks were also made by O. B. Duncan and J. R. Cravath.

The report of the treasurer which was read previous to the address of Mr. Graf showed the club to have a cash balance on hand amounting to $3,759.30.

Boston Subway Development.

An important addition to the existing system of Boston subways will probably be built in the near future, if the Massachusetts Legislature acts favorably upon a report recently submitted to it by the Railroad and Boston Transit Commissions, sitting as a joint board. Expert study of the respective merits of the subway authorized in 1907 under the Charles River embankment, and of a new subway to be built under Boylston Street through the business center of the expanding Back Bay district, led the joint board to recommend the latter, and while the estimated cost of the line is about $1,000,000 more than the river-bank construction would entail, there appears to be no doubt that the Boylston Street route will serve a much greater public and fit better into the subway development which has been systematically furthered in the space of the past few years.

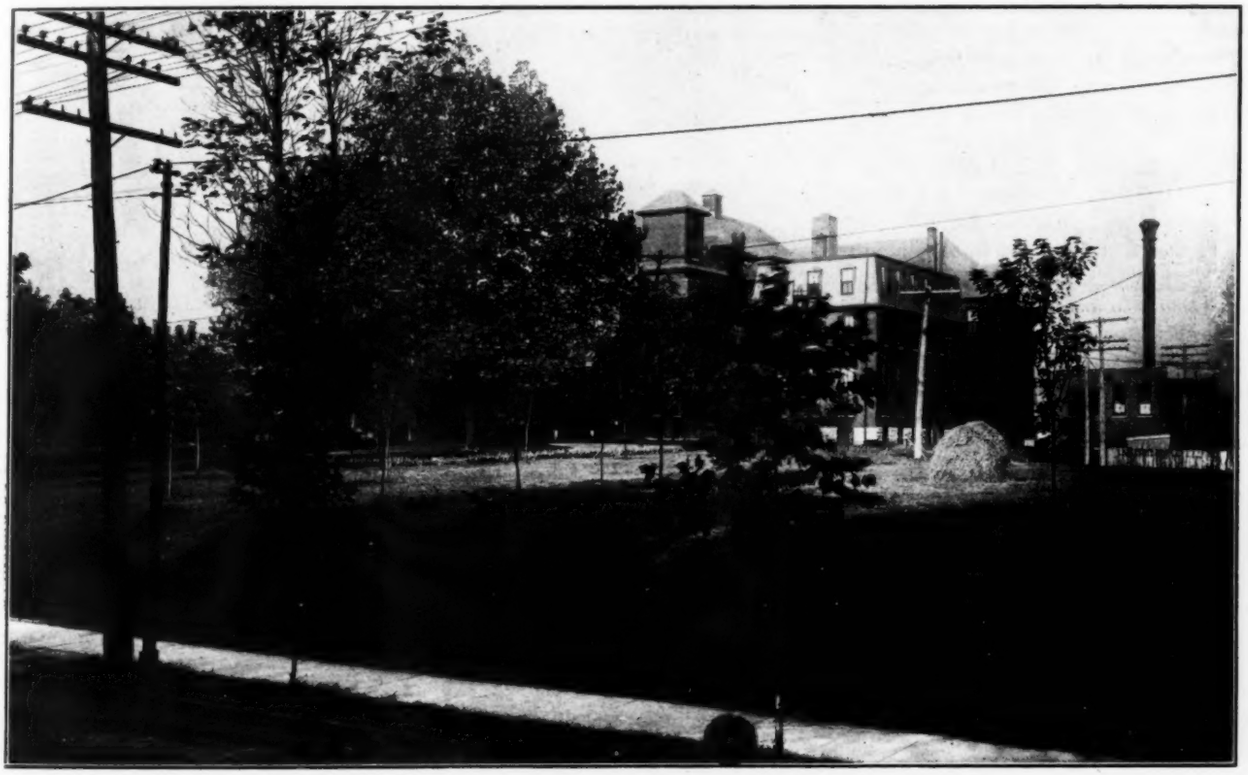
There has recently been a conspicuous development of a commercial character in the Back Bay district, with Boylston Street as its main artery. Residences once occupied by representatives of the old-line Puritan families are giving place to high-class business houses, and in the Huntington Avenue district close by a great amusement and educational center is being formed. Some of the most noted street-lighting experiments thus far performed in this country have been carried on in this general area, and electricity is now to be called into service to furnish the district and its outlying suburbs with real rapid transit. With the approaching completion of the new Cambridge subway and the probable authorization of the Boylston Street tube, the north and south lines of travel in Boston will lose their monopoly of fast transit facilities, and the symmetrical lines of electrical service will be effectively completed.

Isolated Plant for Hospital Service.

Installation, Operation and Economy of the Plant of the Missouri Baptist Sanitarium.

In designing an isolated power plant cost is the dominating feature and too often initial cost determines the fate of the venture. The owner naturally offers a location which is the least valuable for other purposes, which should however, be convenient for receiving fuel and disposing of refuse, centrally located and have ample room.

The heat, light and power requirements are predetermined or readily estimated, and, assuming that the electric system of transmission for light and power are preferable, the type of prime mover must be determined.



GROUP OF HOSPITAL BUILDINGS SHOWING LOCATION OF POWER PLANT.

Producer-gas engines are coming, but unfortunately auxiliary apparatus, and in particular devices for utilizing waste heat, have not kept pace with the engine improvements and cost demands that the waste heat be utilized.

Steam is usually selected and the size and type of apparatus chosen has many governing features. The load curve shown is from the plant outlined below and an average for one year. The load factor is less than the majority of plants, due in part to a light Sunday load. The peak has never reached forty kilowatts and is in the curve distributed over about three hours, and much lighter in summer than in winter. The best results from the engine and generator must be obtained considerably below full load and the human element enters into the selection of the apparatus inversely in proportion to the size. In this instance the single-valve, high-speed, non-condensing engine was used, having ample cylinder capacity which permits of considerable variation in steam pressure and a relatively high back pressure without materially effecting the speed, allowing a safe margin for elevator loads during peak periods. The generator is compound wound for thirty-five degree rise in temperature, direct connected to the engine. The ratio of the connected load to the generator capacity is 2 to 1.

Boiler capacity was in this case determined by the steam heating requirements which were considerably above these of the engine. Tubular boilers were used with down-draft furnaces to meet the demands of the smoke ordinance. The ratio of steam heating surface to boiler heating surface is 115 to 1.

The Missouri Baptist Sanitarium comprises a group of four buildings situated on three acres of ground in the residence portion and near the business district of St. Louis, and with accommodations for one hundred and fifty patients. New buildings are contemplated which will double its capacity.

The demands of an institution of this character are exacting inasmuch as patients are received at all hours, operations are performed and medical attention given whenever necessary and require the use of steam, at both high and low pressure, hot water, light and power. To meet the requirements an isolated plant was designed and installed under the supervision of the Dixon-Smith Engineering Company, consulting engineers of St. Louis, having sufficient capacity to meet the de-

mands of the present institution together with those of the contemplated improvements.

Prior to 1904, light and power were purchased from a central station and steam heat was furnished from two boilers located in the basement of the main building. During the year 1905 a small generator and engine were added which furnished a portion of the necessary light, with results so encouraging that a complete new plant was designed and completed during 1909.

Ventilation of the main buildings is accomplished by means of a pressure blower direct connected to a fifteen-horsepower variable-speed motor which is capable of delivering from six to ten changes of air per hour as desired. Each room is provided with a hand-regulated register for admitting fresh air and an escape vent to the roof for foul air. The temperature of the incoming air is raised as desired during the cold weather by means of heating and tempering coils situated between the blower and fresh air intake in the basement with space allowed for an air washer to be installed at a later time. Exhaust steam is used in these coils which are divided into eight sections and the temperature regulated by cutting in or out of service the necessary number of coils. A vacuum system is used in connection with the heating system and all valves are hand controlled and the results are good. The smaller buildings, corridors and halls are heated by direct radiation using exhaust steam.

Ice in comparatively large quantities is required and a refrigeration plant has been designed for this purpose, which will be located in the basement of the main building. The compressor and pumps will be motor driven and the plant will supply eight fifty-pound cakes of ice each day together with furnishing refrigeration for storage boxes for meat, vegetables, milk, etc., and small refrigerators for the diet kitchens. Water for drinking purposes will be cooled and pumped throughout the buildings.

The laundry, located directly over the power plant, furnishes clean linen for the institution and patients and all equipment is electrically operated giving employment to six people.

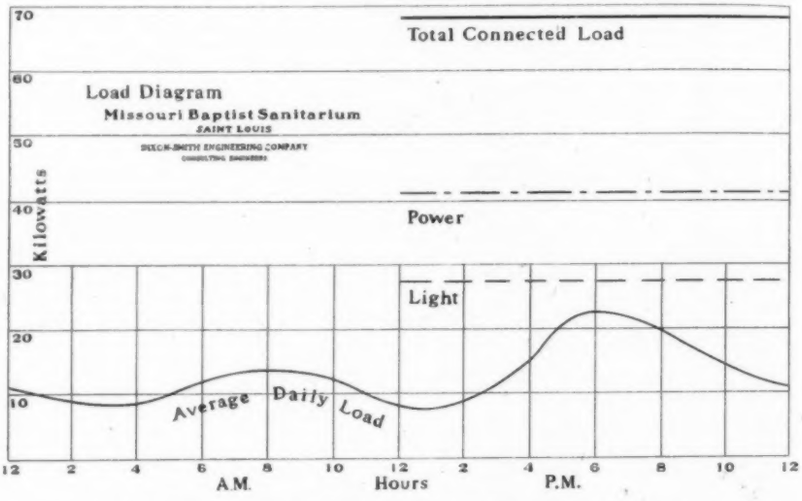
Live steam is supplied to the culinary department, laundry and the steralizers, while hot water in large quantities is used in all departments.

Direct current was selected for power and light, the three-wire 230-115-volt system in use permitting the use of the original electrical equipment. The present connected load consists of 540 sixteen-candlepower lamps, motors, totaling forty-seven horsepower, operating elevator, blower, pumps, laundry machinery, etc., together with electric fans, irons and miscellaneous devices which in all gives a power and light load of sixty-eight kilowatts.

The power plant is a part of the main group of buildings, thus avoiding the dust and noise incident thereto, and is in a building designed for this purpose, together with the laundry which is located on the second floor. A tunnel connects the engine room with the basement of the main building and serves as a passage as well as a duct for carrying pipes and wires.

The engine room is twenty-three by twenty-eight feet and contains two ten by eleven-inch single-valve Harrisburg engines, each direct connected to a General Electric thirty-five-kilowatt three-wire 125-250-volt generator, a switchboard and feed-water heater. The switchboard is of black marble containing two generator panels, and one distributing panel with all instruments finished in black. A Cochrane open receiver-type feed-water heater is used in connection with the heating system, with the piping arranged so that it may be cut out of service for cleaning or repairing.

Two boilers are located in the adjoining room, separated from the engine room by a brick wall. These are each sixty-six by sixteen O'Brein down-draft tubular boilers operating at 125 pounds working pressure. The boiler-feed pumps, water heater and automatic reducing valve for the heating system are located in this room which has a space in front of the boilers partitioned off for storing coal. The down-draft attachment to the boilers has proved of great advantage in preventing smoke, and permits rubbish to be disposed of. The water heater has a capacity for heating 900 gallons of water per hour to a temperature of 180 degrees and is often taxed to its full capacity utilizing considerable of the exhaust steam during the winter months. Live steam is admitted to this heater through an automatic pressure-reducing valve when the back pressure on the exhaust-steam pressure falls below one-half pound.



LOAD CURVE OF MISSOURI BAPTIST SANITARIUM PLANT.

All of the equipment was purchased with the view of economical operation together with simplicity and automatic devices were avoided unless absolutely necessary. The operation of the plant is under the control of a chief engineer who with two assistants comprise the entire crew.

Power is furnished twenty-four hours each day, and the demands are imperative. The equipment is in duplicate, and service has not been interrupted since starting the plant, more than two years ago.

This plant affords an excellent example of the economy of an isolated plant, where exhaust steam can be utilized to advantage. The records of the treasurer for the fiscal years of 1904 when all light and power were pur-

chased and 1910 when heat, light and power were furnished by the plant show the following significant comparative results:

	1904.	1910.
Power	$ 815.68	
Light	1,886.17	
Coal and labor	3,253.24	$3,695.18
Supplies, extensions, repairs, etc.	omitted	616.68
Cost	$5,955.09	$4,308.86
Saving		$1,646.33

In addition to the above saving, the light, power and heating equipment has been increased as follows: Increase in connected lighting load 1904 to 1910, fifty-four per cent; increase in connected power load 1904 to 1910, ninety-two per cent; increase in connected heating load 1904 to 1910, twenty-two per cent.

The comparative cost of light and power for the two years of 1910 and 1904 is as follows:

Cost of operation, 1910	$4,308.86
Interest and depreciation	650.00
Total cost of output, 1910	$4,958.86
Cost of fuel, 1904	$3,253.24
Cost of light and power only, 1910	$1,705.62
Electrical energy used, 1910	105,952 Kw. H. P.
Cost per K. W. H., 1910	.0159

Program of National District Heating Association Convention.

At the third annual convention of the National District Heating Association, to be held in Pittsburg, Pa., June 6, 7 and 8, the following papers will be presented "Investigation on the Transmission of Heat Through Radiating Surfaces," by John R. Allen; "Heating Franchises," by A. C. Gillham; "Results of Measuring Station Load by Venturi and General Electric Meters," by F. C. Chambers; "The Heating and Ventilating Equipments of the City Investing Building, New York City," by J. B. Holbrook; "The Preparation of a Rational Rate System," by R. D. De Wolf; "Superheated Steam," by W. E. Dowd, Jr.; "Handling Customers," by George W. Wright; "Best Systems of Radiation for Economy and Steam Consumption When Fed from a District Heating Station," by Walter J. Kline; "Best Systems for Hot Water," by A. C. Rogers. There will be reports by the Committees on Data and on Radiation.

Trips to steel mills and to the Westinghouse Works, a reception, a smoker and a theater party have been arranged.

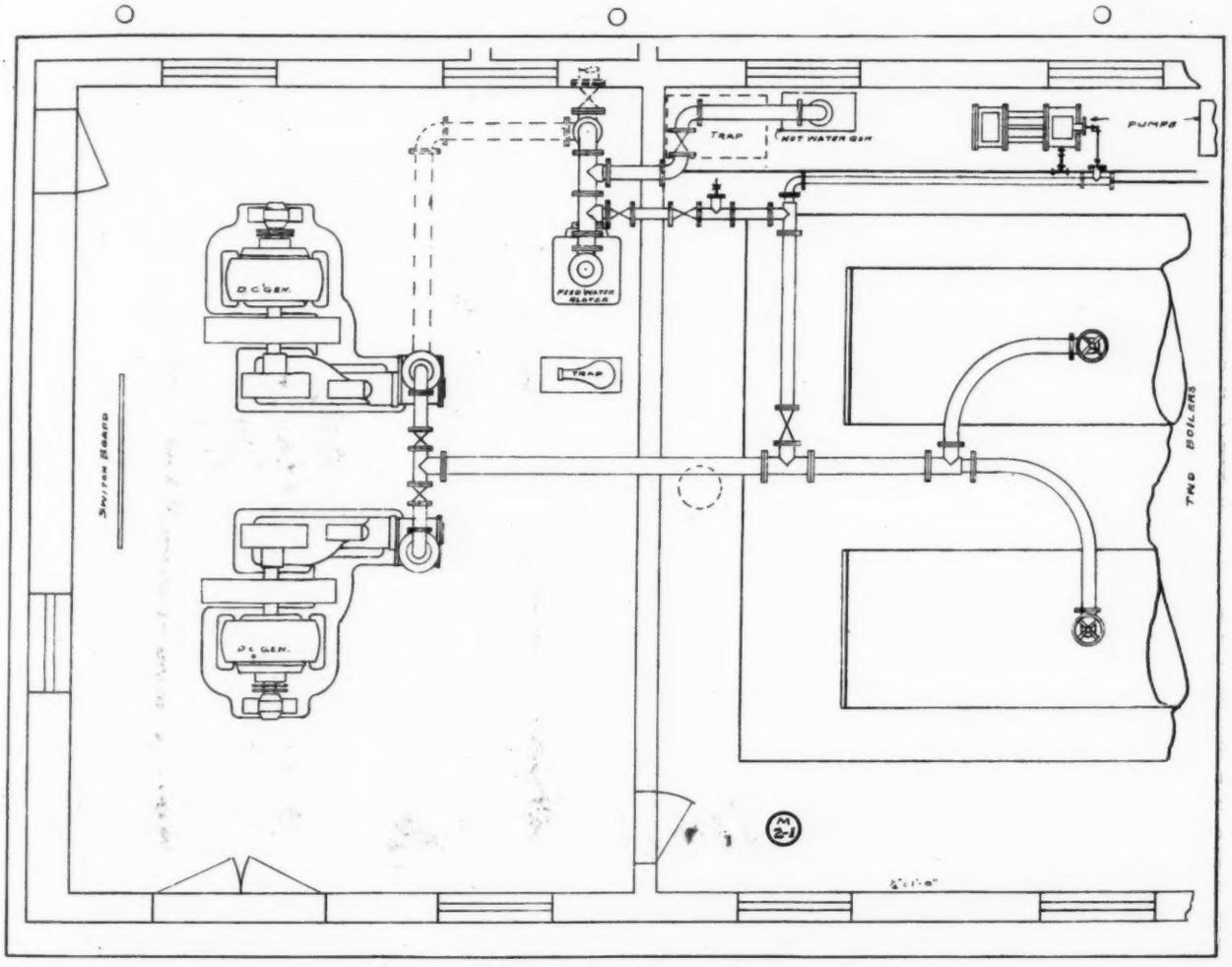
The sessions and exhibits will be in the banquet hall of the Fort Pitt Hotel.

British Association Meeting.

The eighty-first annual meeting of the British Association for the Advancement of Science will be held at Portsmouth, England, August 30 to September 6, under the presidency of Sir William Ramsay.

Water Power in Iceland.

Two English experts have recently visited Iceland in order to survey the large Dettifoss Fall, on the River Iokulsa, which is calculated to have a capacity of 60,000 horsepower. Another less known fall, the Vigaberg Fall, is estimated to have a capacity of 50,000 horsepower.



PLAN OF POWER PLANT.

NEW INVENTIONS BY TESLA.

ADDRESS AT MEETING OF NEW YORK SECTION OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

The meeting of the New York section of the National Electric Light Association was held at the Engineering Societies Building, New York City, on Monday evening, May 15, 1911. Chairman Williams presided. The report of Mr. Thomas, chairman of the Membership Committee, showed that the present membership of the section is approximately 1,300 and it is the aim of the committee to have the membership at least 1,500 by the time of the annual convention of the association, beginning May 29. Chairman Williams then outlined the entertainment to be tendered by the Greater New York lighting companies on the occasion of the convention.

T. C. Martin then introduced Nikola Tesla, preceding the introduction by a statement that the membership of the N. E. L. A. on May 15 was over 8,100, a growth of over 5,000 in eighteen months. Mr. Martin referred to the occasion when Mr. Tesla gave a demonstration of his earlier inventions at the time of the St. Louis Convention in 1893.

Mr. Tesla said that some time ago he experienced the necessity of testing an invention he had perfected under conditions existing in a modern plant and he approached the officers of the New York Edison Company for facilities and received most cordial co-operation, for which he was greatly indebted. He introduced the subject by saying that the gift of invention and discovery is a great one, and that there is no enjoyment that he could picture in his mind so exquisite as the triumph which follows an original invention or discovery. But the world is not always ready to accept the dictum of the inventor, and doubters are plentiful, so that discoverers have often to swallow bitter pills, and he had received an ample share of bitterness as well as pleasure.

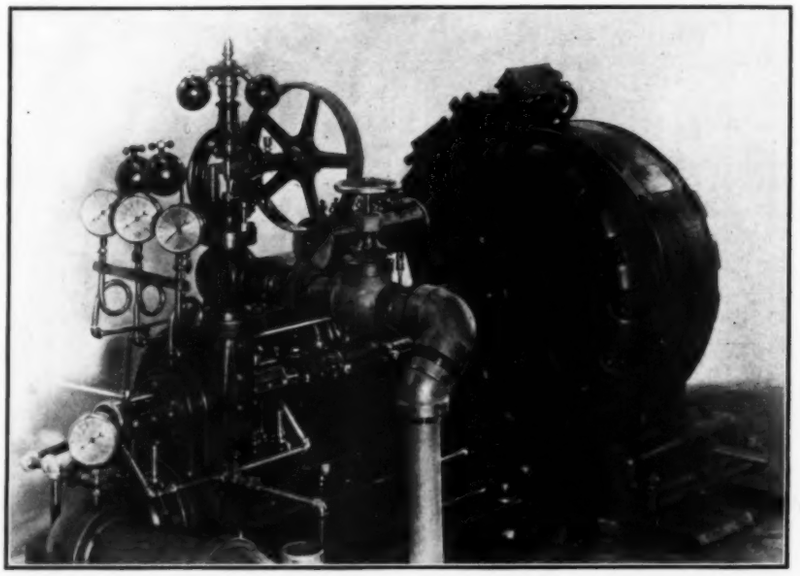
He then referred to the fact that in 1887 or 1888 he had brought out the rotating magnetic field. It was at a time when the world was not yet prepared to receive the idea and he had to stand many attacks, and when his patents were fought he had a great deal of trouble. Some went so far as to assert that he had never invented anything.

Mr. Tesla alluded to the discoveries of Hertz which startled the world. He had tried to repeat the Hertz experiments, worked on them for two or three years and had to give them up. He called on Hertz and told him of his doubts. Since that time he has satisfied himself that Hertz had seen true.

He mentioned the discovery by Roentgen in 1895. He had investigated the wonderful phenomenon which Roentgen investigated, and after long search finally ascertained the true nature of the rays and published the results in a series of papers in the ELECTRICAL REVIEW, declaring we had to deal with a new matter which was never before studied, showing that the particles projected were smaller than atoms, that they were of various sizes, that they carried electrical charges and moved with great velocities.

Mr. Tesla further said that in dealing with electrical matters, there is one branch to which he had devoted a large portion of his life, and it is proper he should speak on that subject. He referred to the wireless transmission of energy. The problem presented itself to him as follows: If we can transmit energy through a closed circuit, we should also be able to transmit it through a single wire, and return being effected through the medium.

He exhibited diagrams illustrating the electrical scheme, as well as a mechanical analog, and showed in slides experiments made in 1899 in which incandescent lamps were lighted in this manner. He then exhibited other diagrams of his wireless system and produced a slide showing a lamp lighted by wireless energy. The lamp he declared could have been lighted if it had been placed at the antipodes. Dwelling on his wireless system in detail he said that it comprised five distinct inventions. The first of these was his transformer. To convey an idea of the wonderful effects which can be produced with that instrument a slide was produced illustrating an experiment performed very frequently in the years of 1892-96. Behind a screen was placed the primary of such a transformer and before the screen a bulb of about fourteen inches in diameter and containing a drop of mercury. The experimenter holds the bulb in the air and the induction from the primary is so strong that it evaporates the mercury and produces an extremely powerful light.



TESLA TURBINE COUPLED TO FIFTY-KILOWATT WESTINGHOUSE GENERATOR.

He next described his "magnifying transmitter" and showed several striking experiments with the same on the screen. One slide showed the transmitter used by him in Colorado on an immensely large scale. Streamers were visible extending from the center of the coil and measuring fully forty feet, the width of the same being sixty-five feet. The discharge is so powerful that it goes through the open roof, being carried up by the heat produced.

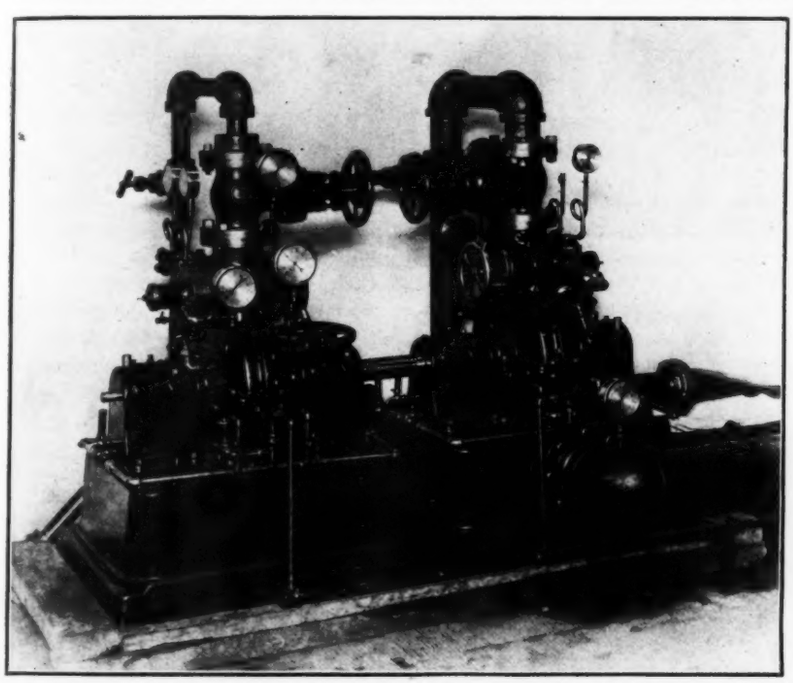
He next showed another effect of such a magnifying transmitter with a large ball, thirty-nine inches in diameter, which was placed just a little above the building, the roof of which was removable. Several of these streamers could be followed a hundred feet into the air; from a distance it looked as if the building was on fire and the roar could be heard for ten miles. He remarked that this was one of the most difficult experiments because of the great force it takes to reach the required density.

Mr. Tesla then referred to his third invention called the "art of individualization in which the nervous system of the human body was imitated in a crude way" (indicating diagram).

"I will not bother you with theories and details," he said, "but can assure you that as long as the world exists, if all men were Faradays, they could never invent a scheme which would permit as accurate a transmission of messages or quantities of energy to a distance through a wire as has been found practicable without wire by this method; for in a wire transmission the secrecy is only the result of isolation in space, while in the wireless we get the benefit of combinations which are not practicable in a transmission through artificial channels. All the statements you read in the newspapers that wireless messages are interfered with, are because the workers in that field are laboring under delusions—they are transmitting messages by Hertz waves, and in this way no secrecy is possible."

He then showed a picture of a machine exhibited in 1898, to which he first applied this art of individualization.

After stating that his fourth invention pertaining to the system was a peculiar receiver condensing the energy, he dwelt on his discovery of the stationary waves which was the last and most important. Before he could transmit energy without wire economically he found it absolutely necessary to learn how this great body, the planet, behaved, how the current would pass through the same and what are its constants, capacity, self-induction and resistance. As he could not find opportunity in the city for investigating he went to Colorado Springs and erected a laboratory for the purpose. Several views of the same were projected on the screen. One showed in the center of the building a coil fifty-one feet in diameter and many smaller ones within, which had been attuned to respond to higher harmonics.



TWO TESLA TURBINES, OF 200-HORSEPOWER EACH, COUPLED TOGETHER BY TORSION SPRING.

Another effect of the magnifying transmitter was next illustrated, showing a display with powerful streamers shooting out in all directions from a coil, as well as a ball of thirty-nine inches in diameter placed on the top.

Mr. Tesla then said: "I had not been in Colorado Springs but a few months when I made the most marvelous discovery I ever expect to make in my life. Before explaining it to you, let me say that I was not stirred at all by its practical value, though it was immense, but by its philosophical significance. You know that through ages past, man has always attempted to project in some way or other energy into space, but in all his attempts, no matter what agent he employed, he was hampered by the inexorable law of nature which says that every effect diminishes with the distance, generally as the square of the distance, and sometimes more rapidly. Now, the discovery I have made upset all that has gone before, for there was a means of projecting energy into space, absolutely without loss from any point of the globe to another, to the antipodes if desired. In fact, a force impressed at one point could be made to increase with the distance. I saw at once that distance was annihilated in all the three aspects; in the transmission of intelligence, in the transport of our bodies and materials, and in the transmission of the energies necessary for our existence. You can imagine how profoundly I was affected by this revelation. Technically, it meant that the earth, as a whole, had a certain period of vibration, and that by impressing electrical vibrations of the same period upon it, it could be thrown into oscillation of such nature that innumerable benefits could be derived from it. Let me tell you of but one application of the principle. Vessels could be equipped with simple devices enabling them to sail across the Pacific along the shortest routes and the captain of each vessel could tell the distance, from a point of reference, within a few feet. We do not today know the exact diameter of the globe. Astronomers have been unable to determine it within a thousand feet. By this discovery without any kind of surveying instrument or even without going out of the room, an electrician can determine the diameter of the globe within four feet. Thousands of such problems, which are of immense practical importance, can be solved and I have often thought that annihilation of distance is the only means of bringing about a quick understanding and universal peace between nations. It will remain for the

future to decide whether I have seen truly or not.

"On my return from Colorado I completed plans to demonstrate these principles on a larger and commercial scale, my laboraory in Colorado being only constructed for purposes of scientific demonstration. Here are some views of my plant on Long Island, erected in 1901. This plant is nothing but what I have called a magnified transmitter which, when completed, will enable you to pick up any telephone and, without the slightest change in the stations, talk as clearly as though sitting on the other side of the table to any subscriber in the world. It will make no difference where he is located, and if desired the voice may be made to come out of the ground with such force that it could be heard for miles. The plant was put up originally for the purpose of serving as such a telephone exchange, but was to serve also for other important uses. To give you an idea of the magnitude of the effects, when you speak into the telephone there will be electrical energy at the rate of one billion horsepower sending your voice across the globe, and not only this, but the plant will be so organized that hundreds of people can talk at the same time to any part of the world without the slightest interference. Of course, you will have to take my word for it now, but I hope that I shall live to realize what I have begun. I will carry out my plans exactly as they were first made.

"My project was evidently far in advance of the times. Its progress was retarded and I was compelled to devote myself for a time to other inventions which appealed more to practical men. After years of careful thinking, I found that what the world needed most, and would most readily accept, was an efficient prime mover, a converter of heat into mechanical energy. This all the more as a new world is about to be explored, the world of waste. When you consider that in the manufacture of steel and iron in this country, some thirty million horsepower could be harnessed and a proportionate income derived from that power, all of which is wasted today, you can see what value a good convertor of thermal energy into mechanical energy would have.

"But to conceive that a prime mover is valuable and to get up one, are two different things. After some thought I finally came to the following argument: suppose a number of plates are moved through a fluid medium, the medium will, of course, be dragged along with the plates, and a certain frictional loss will be incurred. Inside the casing are arranged on a shaft a number of disks with openings and spokes and there are orifices of entrance on the sides to produce a perfect balance, and the usual arrangement of outlets. This system of disks being rotated, the water or air is sucked into the channel, is taken hold of and moves in a logarithmic spiral with very nearly the velocity of the system. It was perfectly well known that a fluid would be dragged by rotating surfaces, but somehow nobody realized the conditions for economic working, nor has any one properly grasped the principles which could be applied to propulsion. So it happens again that it is my good fortune to come to the rescue, and I have produced a highly economical way of compressing or pumping fluids." Mr. Tesla then gave a practical demonstration of the working of the principle in a model pump.

"This is one of the early forms of blower which I constructed" (referring to diagram). "That was constructed three years ago. It is a two-stage blower. Far more important than the pump blower or compressor is the turbine. Here is a simple structure, a casing with two entrances, disks arranged on the shaft and outlets in the center for the escape. In this instance the power is applied to one of the openings and the fluid moves with decreasing velocity toward the center until its energy is exhausted and transferred to the shaft. If the theory is correct, I am able to take out the entire energy of steam in one single stage. In the present turbine, sixty-five per cent is the limit of efficiency; theoretically I should be able to get ninety-nine per cent of the total energy of the steam on the shaft in these turbines. These turbines are simple, they have a great torque, far better than other turbines, and a machine will develop ten horsepower for every pound of weight. This principle can also be applied to the gas turbine."

Several slides showing two turbines coupled together were then projected on the screen and a new method of power measurement described. Mr. Tesla then dwelt on the advantages of these machines and showed a number which were constructed and in operation. They have no ducts, nozzles or such complications which cause so much trouble, and besides the machines are perfectly reversible, working with the same efficiency back or forth, making a valuable machine for driving boats, locomotives, automobiles, etc. The accompanying illustrations show two of these turbines.

"In this new invention we have a beautiful solution of many mechanical problems. We have a prime mover which is reversible, ideally simple, of enormous torque, incomparably greater than the turbine possesses, so I am looking for a revolution in mechanics from the application of this principle."

Owing to the lateness of the hour, the other papers which were to have been presented at the meeting were laid over until the next meeting. The members of the Section and their guests were then entertained by an interesting vaudeville performance.

Gas-Engine Plant in Japan.

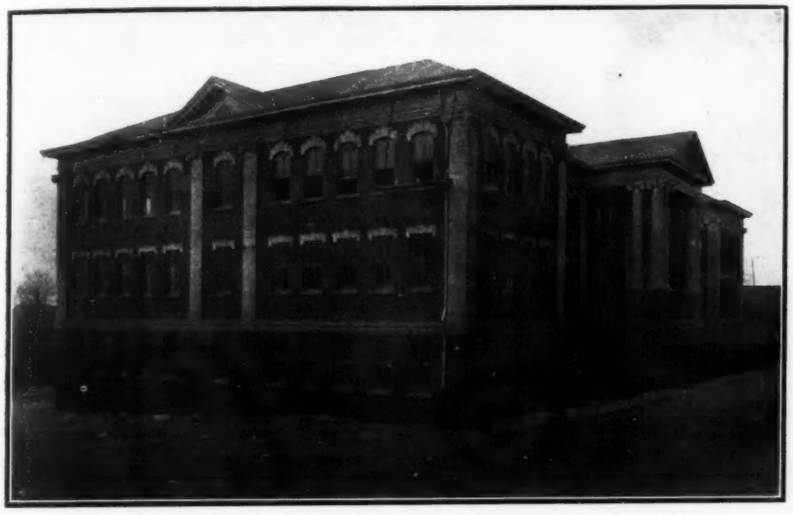
The Japanese Government has placed an order for the complete equipment of an electric power station for supplying electric railways. Mond gas producers will be installed in three units, each unit consisting of three generators and a sulphate-of-ammonia recovery plant. The fuel to be used is of an inferior quality, containing nearly twenty per cent of ash. Most of the steam for the gas plant will be obtained from boilers heated by means of the exhaust from the engines. There will be four Nürnberg gas engines of the double-acting four-cycle type, each of 2,400 brake horsepower, with the cylinders arranged in tandem. The bed frames will weigh fifty tons, and the crankshaft twenty tons. The alternators will be direct-connected to the engines, and run in parallel, the frequency being twenty-five cycles. The section of railway to be electrified is that between Tokyo and Yokohama. The power station will be situated near Yokohama, and there will be two substations, with probably three later on. The erection is to be completed, and the plant put into commercial service, within two years.

A Long Telephone Cable.

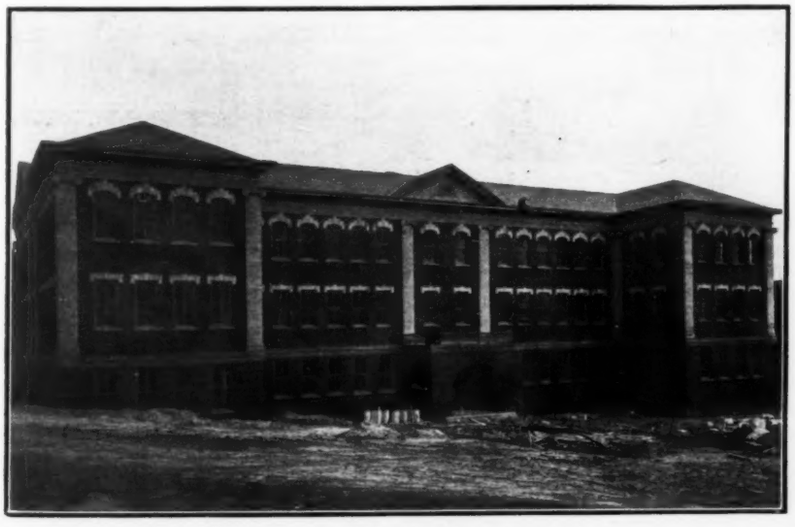
The British Postoffice has decided to build a cable from Holyhead to Ireland, 56 miles long. This will be the longest submarine telephone cable in the world. One cable containing three pairs of wires will be used.

New Engineering Building at the North Carolina College of Agriculture and Mechanic Arts.

In 1887 the State of North Carolina took advantage of the Morrill Act of Congress, whereby the United States gave to the State public lands for the endowment of colleges, and established at Raleigh a college for instructing the youth of the State in the mechanic arts and improved methods of agriculture. Sufficient land for a college site and farm was given by R. S. Pullen, the location being about a mile and a quarter west of the state capitol, somewhat beyond the present limits of the city of Raleigh. The large building now known as the Administration Building was erected and the college was formally opened for students October 1, 1889.



NORTH FRONT AND EAST WING OF ENGINEERING BUILDING.



SOUTH FRONT, ENGINEERING BUILDING.

Since its opening the college has had a steady but healthy growth and, although the state has dealt liberally with it of late years it has been considerably taxed to accommodate the young men who are seeking a technical education. At the present time the college buildings consist of the original administration building; two large and four small dormitories, one of the former having been completed last year; a hospital; a building for the various shops; a foundry; Pullen Hall, containing a large auditorium, the library, and the dining hall; a textile building, which in design and arrangement is similar to a cotton mill; a large building for the agricultural department; a modern power house, supplying light, heat, and power to the entire college; and a new engineering building, which will be put into service this spring.

The new building is intended to relieve the pressure for space which has greatly hampered the departments of electrical engineering, civil engineering and chemistry. The number of young men registered in these departments is nearly two hundred and has been increasing at a rapid rate. The first two departments, up to the present time, have had rooms in the basement of the administration building, while the former power house, a one-story brick building, has been used for a dynamo laboratory.

The new building is placed on Hillsboro Street, the main thoroughfare to the college, about four hundred feet north of the new power house. About two hundred feet to the east stands the present textile building, and it is the purpose of the college, sometime in the future, to erect two other engineering buildings south of these two, making a quadrangle with the power house not very far from the center.

The new building is three stories high, including the basement. It is of red brick with buff brick pilasters and cornice, with a belt of the same material surrounding the building at the base of the pilasters. All of the buildings of the college, with the exception of the Agriculture Building, are of red brick, so that the new building harmonizes well with its surroundings. The floors in the new building are of reinforced concrete and all partitions are of brick or gypsum blocks.

The site selected for the building lies somewhat below the level of Hillsboro Street. This brings the main floor of the building to the street level and gives a large high basement excellently adapted for laboratory purposes and test rooms.

As it is intended for this building to house, not only the two engineering departments mentioned, but also the department of chemistry and the chemical division of the State Experiment Station, which is co-ordinated with the college, the entire upper floor has been turned over for the work in chemistry. The main floor and basement are divided between the departments of electrical engineering and civil engineering, the former taking the west end and the latter the east.

The general plan of the building resembles somewhat the letter **H**, there being a main section joining together

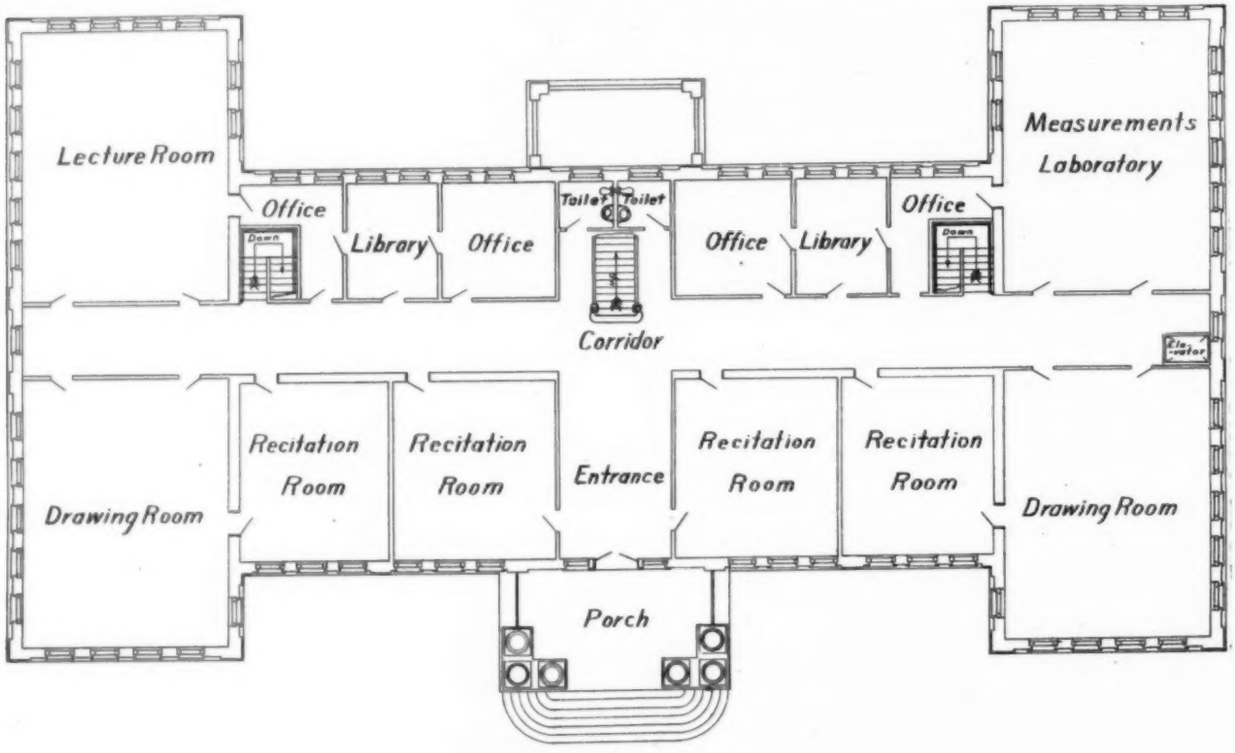
two wings. The over-all dimensions are 170 feet by 90 feet. The main section is 106 feet long by 56 feet wide. The wings are 90 feet long by 32 feet wide; thus each floor has a total of about 11,000 square feet of space, half of this being in the main section and half in the wings; the total being about 33,000 square feet. Each of the departments has the equivalent of one floor in space.

The west end of the first floor and basement will be given up to instruction in electrical engineering. To the right of the main entrance are a recitation room and a lecture room about 21 by 25 feet and 25 by 23 feet, respectively. Across the corridor on the south side of the building are the department library and offices. The west wing of the building on this floor is divided into two rooms, each 38 by 29 feet. The one to the north will be used for drafting and designing; that to the south for electric and magnetic measurements and for standardizing instruments. The latter room is furnished with electrical supply from the laboratory in the basement and from the storage battery, conduits being laid in the wall and under the floor for this purpose. One of the large rooms in the east wing will be available when a large lecture room is needed.

The basement is reached by two stairways, one at each end of the building, these affording convenient communication for each department between its rooms in the basement and those on the first floor. The entire basement of the west wing is given up to the dynamo laboratory, making a room 87 by 29 feet. This room is provided with ducts in the concrete floor, two of these running the entire length of the room and two running across; the latter serve not only to cross-connect the two main ducts but also extend to the other rooms in this end of the building.

The electrical equipment will be arranged conveniently along the two main ducts. No shafting will be used but all machines will be arranged in pairs. All wiring will be concealed except that necessary for connection at the various testing stations at each set of machines.

The power supply of the laboratory is furnished from the college power house by three independent lines. One three-phase 550-volt circuit furnishes power directly to the laboratory motors. A second similar circuit provides supply for all the transformers and lighting of the building. A third circuit gives a direct-current supply from the large steam-driven exciter in the power house. All power supply about the college is by three-phase currents, with the exception of the occasional needs of the dynamo laboratory and one slow-speed motor driving a high-pressure water pump in the pump house. The supply enters the laboratory by means of conduits at the angle between the main section of the building and the west wing, on the south side. At this point is placed the transformer rack on which will be three 10-kilowatt, 550 to 110-volt transformers from which the laboratory supply at 110 volts, one, two, and three phase will be drawn. Here there will also be placed the small distributing switchboard for conveniently supplying the necessary power to any part of the laboratory.



FIRST FLOOR PLAN.

Adjoining the laboratory on the south side of the building is a small laboratory office and instrument room. Next to this, and communicating with it, is a room for high-potential work. Adjoining the latter is the departmental shop. On the other side of the corridor will be the storage-battery room next to the main laboratory, then follows the photometric laboratory and next the store room for supplies.

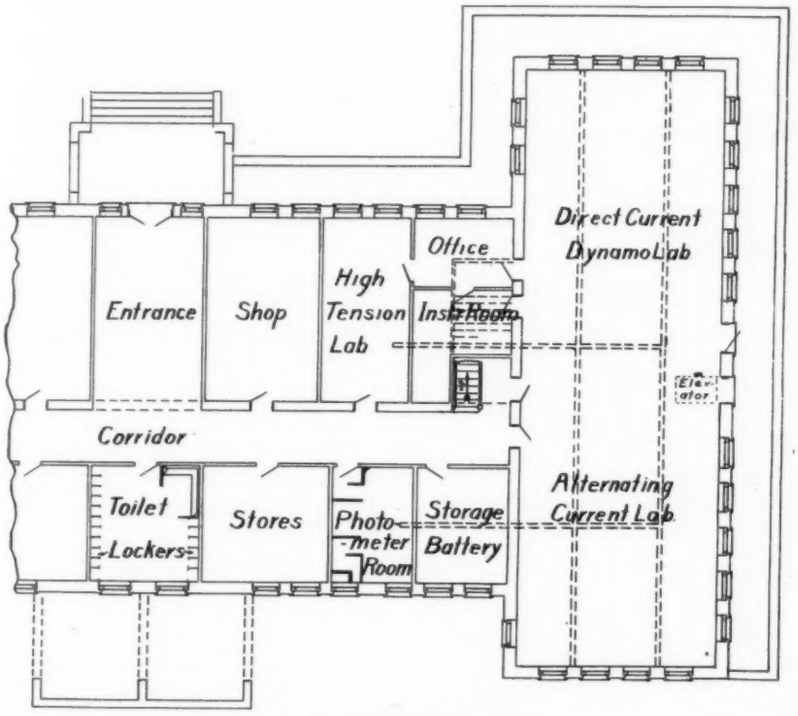
The recitation rooms on the first floor are well equipped with electrical service for use in experimental lectures or demonstration work.

The equipment of the department of electrical engineering, while not large, is well diversified. In addition to the transformers already mentioned there is a pair of seven-kilowatt transformers which can be used not only for the Scott connection but also as auto-transformers. Another transformer supplies current up to 200 amperes at from five to eighty volts, and there are various others of different types and makes, including one General Electric constant-current arc-lamp transformer. Among the machines there is a forty-kilowatt three-phase synchronous motor, a twenty-kilowatt two-phase synchronous motor, with two and three-phase induction motors of various makes, small synchronous motors, and a repulsion induction motor. There are small single and polyphase generators, arc-lighting generators, direct generators of various types and sizes, a set of railway motors, a rotary converter, motor starters, rheostats, condensers and other necessary appliances. The equipment in the power house is also used for testing purposes.

The equipment of instruments is varied, practically all the standard makes being represented. For photometric work various types of arc and incandescent lamps and a mercury-vapor lamp are provided.

For advance electrical measurements specially wound galvanometers, potentiometers, magnetic standards, standards of resistance, standard cells, and the necessary accompaniment of resistances, Wheatstone bridges, etc., are provided. The laboratory will be arranged so that the accuracy of any instrument may be checked within a few minutes.

The building is heated by exhaust steam from the power house, by the Warren & Webster system. The steam main and the pipe for the water of condensation are laid in the H. W. Johns-Manville Company's conduit. This consists of 15-inch tile pipes laid on a gravel bed, under which runs a tile drain pipe. The conduit is bedded in sand. The six-inch steam main is placed nearly in the center with the return pipe for condensed water a little to one side, and the conduit is packed tightly with asbestos. The college has had a good deal of trouble with the old heating mains, which were laid on another system, but anticipates no trouble at all from the new line, which was excellently laid.



BASEMENT PLAN.

The eastern section of the building will be occupied by the department of civil engineering. It contains two recitation rooms, a large lecture room, a large draughting room, department office and library, all on the main floor. In the basement are a large laboratory for testing materials, a draughting room, instructor's office, instrument rooms and store rooms. This floor also contains a wash room for the use of students.

On the second floor of the building are the lecture rooms, recitation rooms, and office of the department of chemistry, and the office and laboratory of the chemical department of the State Experiment Station. The work of all three of these departments has been carried on mainly in the Administration Building and has been much hampered for lack of room. The removal to the new building will leave room for a greatly needed increase in space devoted to the work in physics, which is under the direction of the professor of electrical engineering and which is now crowded into one end of the basement of the former building.

A word or two about the equipment in the power house may not be amiss. This was put into service about four years ago. The building is of brick with an Alphonse Custodis chimney. It is placed nearly centrally with respect to the quadrangle of engineering buildings which it is hoped will be a part of the college within the next few years.

The electrical equipment consists of an 80-kilowatt, three-phase, 550-volt, revolving-field Crocker-Wheeler alternator, direct-connected to a Skinner engine, and two 50-kilowatt, three-phase, 300-volt, Crocker-Wheeler revolving-field alternators, connected in series and driven by a DeLaval steam turbine. The latter unit has a direct-connected exciter. There is, in addition, a motor-driven exciter and a ten-kilowatt direct-current generator, driven by an ABC engine, which serves as an exciter and also supplies small demands for direct current for pumping and for the dynamo laboratory.

The switchboard is of standard Westinghouse panels, there being two generator panels, a distributing panel, and an exciter panel. On the distributing panel are mounted the recording voltmeter and the watt-hour meter. At the present time the normal output of the power house is about 350 kilowatts per working day of twenty-four hours. During the winter about 150 kilowatts are required to supply the lighting load and the remainder is necessary for operating the various shops. It will be seen that the power house equipment will be ample to meet the demands of the college for some time.

The college makes use of electrical power wherever possible. All the shops and the textile building are driven by three-phase induction motors and the work at the barns, such as cutting ensilage and grinding feed, is done by means of a semi-portable motor of the same type.

As mentioned above, the college is greatly overcrowded, both with respect to dormitory and class-room facilities. The new building will help very materially in relieving the latter pressure and it is expected that the State Legislature will make provision this spring for relieving part of the former and perhaps provide other improvements.

Engineering Specifications.

At the May meeting of the Armour Institute of Technology Branch of the American Institute of Electrical Engineers, held in Chicago, May 11, Frank F. Fowle presented a very interesting paper on "Engineering Specifications."

The importance of engineers familiarizing themselves with business law, embracing contracts, specifications, etc., was pointed out, this work bearing to the engineer's larger sphere of usefulness the same relation that the purely technical training bears to his purely scientific work.

Specifications and contracts were defined in general terms and their relation to each other pointed out. There are four essential and fundamental elements in any contract: (1) competency; (2) legality; (3) agreement, and (4) consideration. The several ways in which a contract can be discharged are: (1) performance; (2) agreement; (3) impossibility of performance; (4) operation of law, and (5) breach. The methods of advertising for bids covering private and public work is demonstrated.

Regarding specifications there are three plans of proceeding with their preparation, namely: complete plans in detail, general plan only, and no plan whatever. Mr. Fowle stated that the first plan is probably the safest one and the one most generally followed. All responsibility rests on the engineer. The second method can be followed where details are not highly essential. The third method depends for success upon the dependability of the contractor and is often followed, to some extent, where the owner limits his expenditures for engineering to a very meager amount.

There are no hard and fast rules in preparing specifications, and the engineer's judgment and experience come into play to a great extent. Mr. Fowle warned against copying existing specifications. A good command of clear English is one of the most important qualifications and of equal importance is the need that the engineer shall be qualified by experience as well as theoretical knowledge in the field which his specifications will cover. The language should be as definite and simple as possible, avoiding obscurities, or double meanings. In case of very large or comprehensive work it is advisable to draw separate specifications for each unit or component part.

Some of the general and technical clauses which a set of specifications should embody were enumerated and in conclusion Mr. Fowle exhibited a number of sample specifications.

Supply of Cedar Poles.

Secretary R. M. McKinney, of the Northwestern Cedarmen's Association, has issued the following report showing conditions governing the present supply of white-cedar products and a forecast of what is likely to result before the close of the year 1911.

The white-cedar situation at the present time and conditions governing the same show that seasoned stocks of all lengths of posts and poles are unusually low. Indications are that dealers are facing a steadily increasing demand for stock, with a much smaller source of supply than at the same time a year ago. With an increase of consumption of ten per cent in 1911 over 1910, stocks of all sizes from seven-foot posts up will be practically wiped out before another logging season is finished.

Statistics show that on January 1, 1910, there were on hand about 3,300,000 more pieces of all sizes from seven-foot posts up than on January 1, 1911, and about 875,000 more poles from sixteen feet up. The production for the winter of 1910-1911 is easily twenty per cent below the estimate, which added to the greatly reduced condition of the seasoned stocks on hand, point to very little stock being left in the hands of the dealers January 1, 1912.

The report of the Bureau of the Census, Department of Commerce and Labor, shows that in 1907, 2,109,477 cedar poles were used in the United States; in 1908, 2,200,139 and in 1909, 2,439,825, an increase of 15.6 per cent in 1909 over 1907. It is a conservative estimate that the consumption of cedar poles in the United States in 1910 exceeded 1909 by ten per cent and indications are that 1911 will exceed 1910 by the same ratio, which would show a consumption in 1911 of 2,952,187 poles of which possibly 500,000 would be Idaho or Western cedar, leaving 2,452,187 white cedar poles to be used. The following schedule shows the estimated 1911 available supply of poles as compared with 1910. As shown by this schedule, should the consumption of poles in the United States in 1911 come up to the estimate, there would be between 850,000 and 900,000 less poles on hand January 1, 1912, than on January 1, 1911. This conclusion is reached as follows:

1910.	Poles.
On hand January 1, 1910, 16 feet and up	2,293,761
Production winter 1909-1910, 16 feet and up	811,800
Total supply, 1910	3,105,561
1911.	
On hand January 1, 1911, 16 feet and up	1,422,244
Production winter 1910-1911, 16 feet and up	1,238,400
Total supply, 1911	2,660,644
Available supply, 16 feet and up, in 1910 exceeded 1911 by	444,917
GOVERNMENT REPORT.	
Cedar poles consumed in U. S. 1908	2,200,139
Cedar poles consumed in U. S. 1907	2,109,477
Increase 14.3 per cent over 1907	90,662
Cedar poles consumed in U. S. in 1909	2,439,825
Cedar poles consumed in U. S. in 1908	2,200,139
Increase of 10.8 per cent over 1908	239,686
With an increase of 10 per cent over 1909 the pole consumption for 1910 was	2,683,807
With an increase of 10 per cent over 1910 the pole consumption for 1911 should be	2,952,187
Deduct for Idaho or Western cedar poles	500,000
1911 consumption of white cedar	2,452,187
Available stock on hand 1911, reported	2,660,644
Add 25 per cent for stock not reported	355,661
Total stock on hand 1911	3,016,305
Estimated consumption white cedar poles, 16 feet and up, 1911	2,452,187
Leaving probable stock on hand January 1, 1912	564,118
Stock on hand January 1, 1911	1,422,244
Decrease in stock on hand	858,126

Subway Plans to be Publicly Discussed.

At the meeting of the Chicago City Council, held May 17, the sub-committee of the local transportation committee recommended that a series of public hearings be given the pending subway plans. The first hearing will be held May 22, when the engineers advocating the three plans for a subway will discuss their views.

At the Council meeting Mayor Harrison recommended to the committee that the City finance, construct and operate the subway and not avail itself of the $5,000,000 which the two street railway companies would be forced to contribute, under the ordinance of 1907, if a co-partnership arrangement was made.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS.

FOURTH ANNUAL CONVENTION AT LITTLE ROCK, ARKANSAS.

The fourth annual convention of the Arkansas Association of Public Utility Operators was held at the Marion Hotel, Little Rock, Ark., May 3, 4 and 5. The attendance surpassed that of any previous meeting of the Arkansas Association and the program of papers and entertainment features left nothing to be desired.

The routine work scheduled for Wednesday morning was postponed until after the afternoon session and the morning given over to the registration details.

The afternoon session was called to order promptly at 2 p. m. by President Byron C. Fowles, of Pine Bluff, and W. W. Wood, Jr. presented a paper on "The Effect of Natural Gas on Municipalities," pointing out the benefits that will result from the pipe line now being laid in Arkansas from the Louisiana fields. Mr. Wood called attention to the many advantages and economies of natural gas for commercial fuel, pointing out the results from its use in the plant of the electric plant in Texarkana.

In the discussion, which was participated in by Messrs. Hegarty, Fowles, Mitchell and Riedel, it was brought out that in the south, natural gas would not compete with electricity for lighting, on account of the intense heat given off by the gas light. Mr. Wood in reply to a question said that $700 covered the expense of equipping his boilers with gas burners and the saving was about $13,000 during the first year.

J. M. Hewitt, of Mariana, then read a paper entitled "The Rate Question." This paper traced the developments of rates for electricity, emphasizing the fact that all costs should be determined and, after adding only reasonable profits, such rates should be adopted that all classes of business would produce about equal returns. Rates should be so made as to invite new business.

Following a general discussion in which it was brought out that a company's books should not be exposed to the public, but that an engineer, acceptable to the city and company, be made arbitrator in any rate controversy, a paper by W. C. Maguire, entitled "Water" was presented.

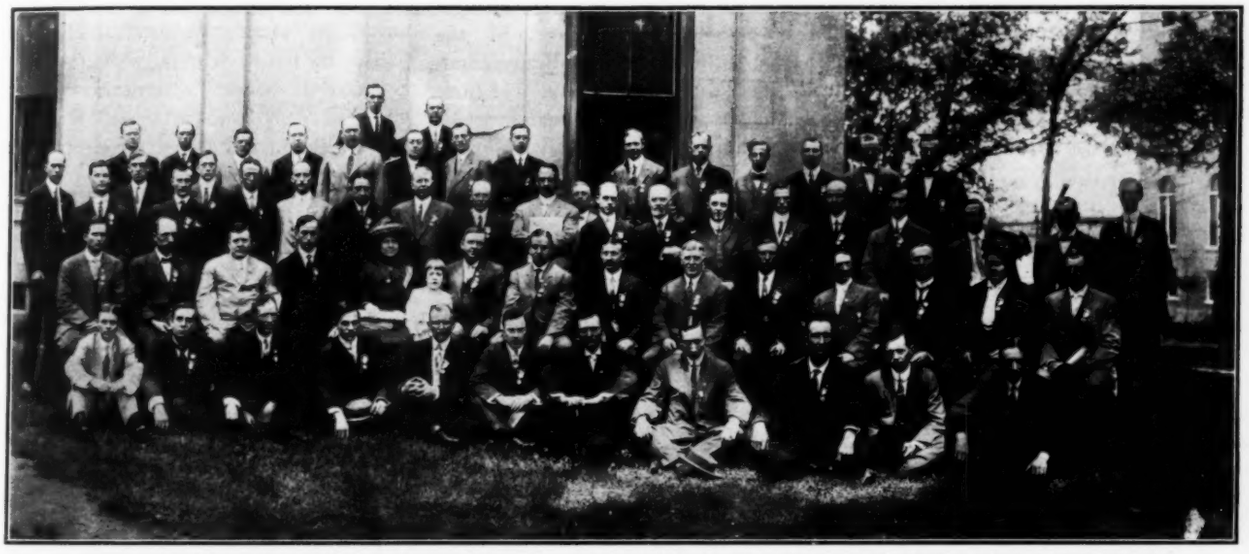
The concluding business on Wednesday was the reports of the executive and legislative committees and the president's address. The committee reports were presented by D. A. Hegarty, who reported that during the year several bills were shown to be unfair to public utiliy companies and were killed. In his address President Fowles spoke of the work of the Association and urged that still greater efforts be made for its advancement.

At the session on Thursday morning M. Q. Woodward, of Pine Bluff, presented a paper on "New Business," which pointed out the necessity for an active new-business policy. The best adjuncts of a new-business department are a complete knowledge of the proposed customer's need and unfailing tact in approaching him.

The paper was discussed by Messrs. Fletcher, Hegarty, Fowles, Wood, Leake, Brown and Riedel.

A paper by D. A. Hegarty, entitled "Roadbed Construction," was then presented.

The afternoon session was opened with a paper by Mr. F. C. Bragg, entitled "Relations Between Contractors and Central Stations," the keynote of which was co-operation. In the discussion all central-station delegates expressed the desire to work in harmony with the contractors.



GROUP AT THE CONVENTION OF THE ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS, LITTLE ROCK.

The next paper, devoted to a description of the single-phase induction regulator and its relay and auxiliary devices, entitled "Feeder Regulators," was presented by C. E. Allen.

On Friday morning a paper by W. J. Thorpe, of Little Rock, entitled "General Accounting, Public Utility Corporations," was presented by the author. This paper comprised an accurate description of the accounting methods employed by the Little Rock Railway & Electric Company.

An executive session followed, at which the following officers were elected for the ensuing year: President, J. M. Hewitt, of Mariana; vice-presidents, W. L. Wood, Jr., of Texarkana, J. W. McLendon, of Fayetteville, and W. C. Maguire, of Arkadelphia; secretary, W. J. Thrope, of Little Rock; and treasurer, E. Hardin, Hot Springs.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ELEMENTS OF POWER-STATION DESIGN.—XXXI.

TYPICAL HYDROELECTRIC PLANTS.—II.

BY W. B. GUMP.

In the description of the Minidoka power plant that appeared in last week's installment, brief mention was

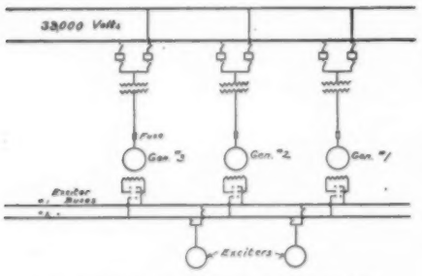


FIG. 8.—WIRING SCHEME, MINIDOKA PLANT.

made of the electrical features of the plant. All the generating apparatus is connected on the unit system to duplicate high-tension busbars. The generators are connected directly to the step-up transformers, the high-tension coils

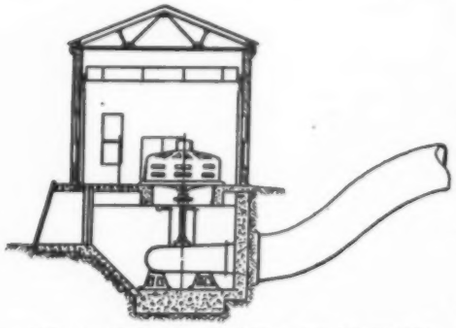


FIG. 9.—TYPICAL SECTION OF MINIDOKA PUMPING STATIONS.

of which connect through remote-control oil switches to the 33,000-volt busbars. The general scheme is shown[1] in Fig. 8.

The transmission lines, one of which is in service and the other under construction, are twenty-two miles in length. They run nearly parallel. One of them crosses the Snake River in an 1,150-foot span. These two lines can be connected separately to either bus, but normally they will be joined as a loop system through the three pumping stations and the towns on the project that are being supplied with light and power.

The general arrangement of the pumping stations is shown diagrammatically in Fig. 9. Careful study of their requirements led to the adoption of vertical-shaft centrifugal pumps direct-connected to superposed synchronous motors. A total of twelve pumping units is provided in these stations and the combined pumping capacity is 1,400 cubic feet per second. The lift of each pump is thirty-one feet.

The design of the Minidoka plant was supervised by O. H. Ensign, chief electrical engineer of the United States Reclamation Service. The construction was carried on under the immediate direction of R. B. Keese.

HYDRAULIC POWER COMPANY'S PLANT.

A development of much greater capacity than the one last described, and yet similar in one respect, is that of the Niagara Falls Hydraulic Power & Manufacturing Company, at Niagara Falls, N. Y. This development comprises a diverting canal at the end of which the water is dropped through penstocks, producing an effective head of 210 feet.

The station as originally planned was to contain eight alternating-current units of 6,500 kilowatts each and five direct-current units used for electrolytic

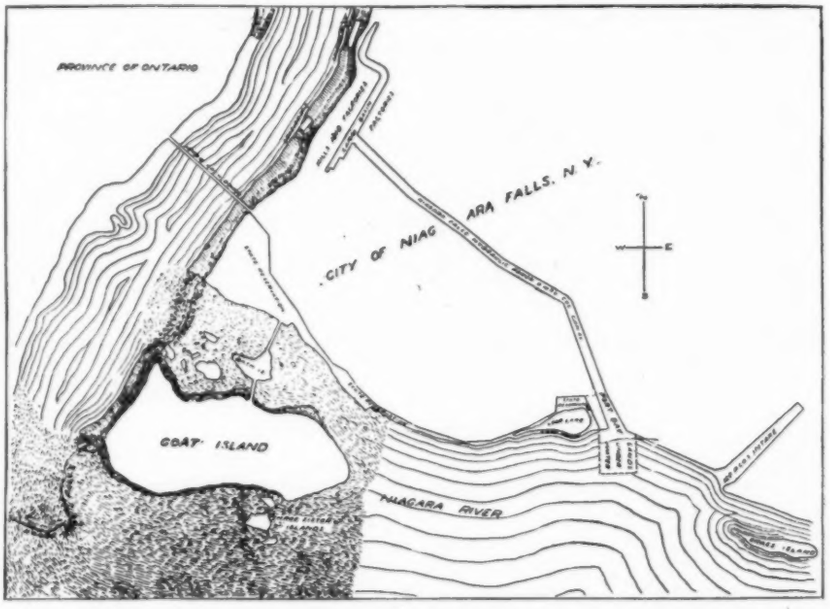


FIG. 10.—MAP SHOWING INTAKE, CANAL AND POWER STATIONS NO. 2 AND NO. 3 OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

reduction, the ultimate capacity of the plant being approximately 100,000 horsepower. The alternators, two of which have been installed, are three-phase, 12,000-volt, twenty-five cycle machines, operating at a speed of 300 revolutions per minute. The turbine units are of the horizontal type, the normal capacity of each water wheel being 11,000 horsepower.

The alternating-current generators are rated so as to permit a continuous

1 Through an unfortunate error the wrong illustration was used for Fig. 8 on page 950 in the last issue. The correct diagram appears above.

capacity of 7,320 kilowatts, or approximately 7,500 kilowatts. The rotor is built up from a solid disk of nickel-steel forming the hub, on each side of which is mounted a nickel-steel ring. These two rings are securely fastened to the central portion by keying.

Chiefly on account of the environment, it was found advisable to adopt horizontal units and to place the operating gallery and main switching apparatus on the side next to the river, since the nature of the bank below was such as to readily accommodate a filling of material taken from the cliff side, and thus form a practically level plane of sufficient width for horizontal units. The adoption of a vertical system involved excavating of an unfavorable character, and introduced other factors which at the outset were considered objectionable.

Plans for this development were begun in 1903, but were not hurried, as the existing plant owned by the same company, involving 34,000 horsepower, was serving the immediate community. Both developments receive their supply from the same diverting channel or canal. The intake, or mouth of this canal, is located at a point several hundred yards below that for the plants of the Niagara Falls Power Company, and extends through the center of the city of Niagara Falls, terminating at the forebay of the plant being described. Observing the map, Fig. 10, it will be seen that the intake is designated as Port Day, so named from a man of the name Horace Day, who many years ago was interested in this canal.

Station 3 (the new development) is located about 500 feet down stream from Station 2, the latter having been known for many years as the Schoellkopf plant.

The forebay, situated just above the cliff, is effectively constructed with massive concrete retaining walls, and represents excellent modern practice. It is 450 feet in length, exclusive of an ice runway located at the up-stream end of the forebay wall. The front concrete retaining wall is thirty feet high, and has a base twenty-four feet in width. The rack system, bellmouths, drains, etc., are suitably constructed to accord with the tops of the penstocks. When constructing this wall, it was made up in sections having the joints come between the penstocks.

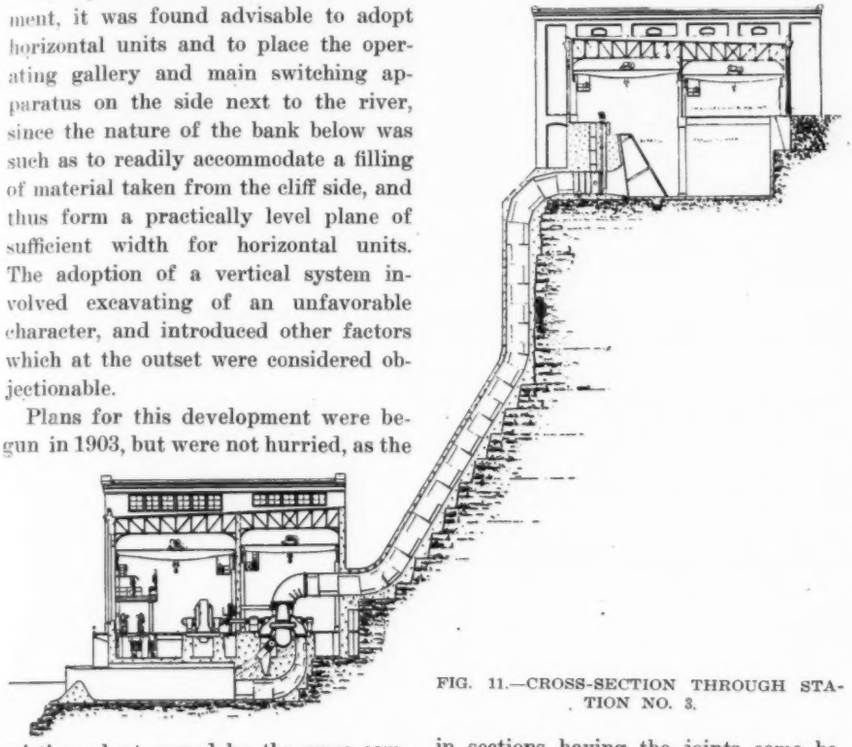


FIG. 11.—CROSS-SECTION THROUGH STATION NO. 3.

The water entering the forebay passes under structural steel head gates. The friction of these gates due to water pressure is reduced by means of roller bearings, thereby minimizing the power required for their operation. Under full capacity conditions the velocity of water entering the forebay is 4.0 feet per second, and is gradually reduced to 1.5 feet per second at the racks. The water entering the bellmouths in the concrete forebay wall, passes through Coffin gate valves nine feet in diameter, which is the same diameter as the penstocks. Each gate valve is electrically operated, and is under the control of the operator in the main station below. The penstocks are imbedded in concrete for their entire length.

The station proper is situated directly at the foot of the cliff and is approximately 500 feet in length by 95 feet in width. As will be seen by the sectional drawing, Fig. 11, a concrete wall separates the water wheels from the generators, this wall extending the full length of the building.

The hydraulic design of the water-conducting system demanded an effective means of taking care of the water ram due to the sudden closing of the turbine gates. On account of inclosing the entire penstocks in concrete, there was no opportunity for relief valves of ordinary construction. Provision against disaster was therefore made by employing a bursting plate in each wheel case, eighteen inches in diameter, and of such thickness that it will give way under pressure slightly in excess of that due to the normal operating head. A valve is also secured to the wheel case in such a manner that in the event the bursting plate gives way, the valve may be closed and the plate renewed without any interruption to service.

The decision to adopt a generator speed of 300 revolutions per minute was not hastily arrived at, since it involved a load per bearing greatly in excess of that found in the usual practice. Careful tests, however, demonstrated that the unit in question would be running well within the limits of safety. The economy in the cost of the units, as well as the saving in floor space, compared to a lower speed, was very marked.

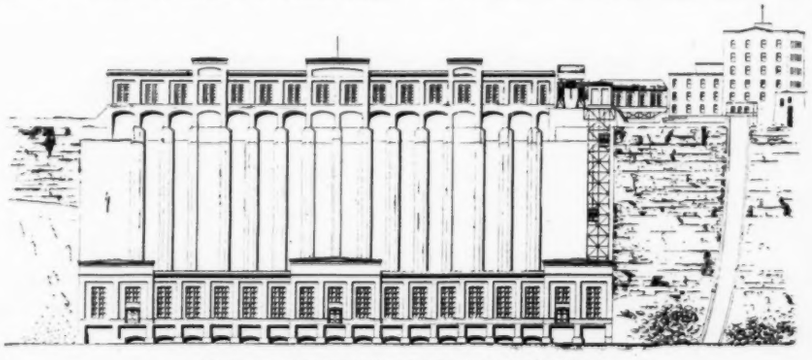


FIG. 12.—RIVER VIEW OF STATION NO. 3.

The installation of machinery for this station has been effectively provided for by the equipment of a specially constructed crane, overhanging the cliff. This crane is fifty tons capacity and is arranged to run upon an elevated track under which machinery may be hoisted from the freight cars, conveyed to a point immediately above the station, and finally lowered to a track 200 feet below, where it is conveyed to the station floor. By means of this crane it is practicable to lower freight cars to the site below, placing them upon the track leading into the station. There are two passenger elevators located adjacent to the crane, as shown in Fig. 12.

A few remarks are in order concerning the ice conditions during the winter months. For the sake of those not familiar with the surroundings at Niagara Falls it is well to state that vigilant attention is required to prevent ice jams of a serious nature. In the plant here described the accumulation of ice in the canal is taken care of by means of an ice runway. The ice is conveyed to the upper end of the forebay through what may be termed a diverting channel, and from there is carried down the ice runway or chute, into the river. This ice chute may be seen at the right in the front view of the station in Fig. 12. In contour the ice chute conforms to an ogee curve.

The electrical layout comprises a number of features of interest. Its design was taken in hand by the writer in August, 1905, under the general supervision of John L. Harper, chief engineer of the company. With but slight modifications the original plan has been adopted. The scheme of switching is in the form of a ring bus, shown in Fig. 13. It is well to note here that the district supplied from this system is embraced within a short distance from the plant, serving only the city of Niagara Falls. On this account no long-distance transmission lines are necessary. The potential at the buses is 12,000 volts between phases, thus eliminating large power transformers at the station.

The switching is so arranged that any generator or group of generators may feed directly to the lines independent of the station bus. The bus may be sectionalized into an upper and lower bus, permitting any machine to energize either bus, operating alone, or in combination with other units. While requiring a rather large number of oil switches, yet this arrangement is probably as flexible as any which could be devised, since it allows a segregation of loads in almost any manner desirable.

A particularly notable feature of the electrical system is in the outgoing line. Instead of suspending line conductors from the station to the top of the cliff, it was deemed advisable to construct a cable shaft, having a vertical rise of about 225 feet, in which lead-covered cables are hung. The method of holding these cables in place involves a system which prevents creeping, without undue pressure upon the lead sheath. A special form of wedge clamp is employed, spacing these clamps several feet apart, all the way up the shaft. A similar method having been in use at the old station for a number of years was proof of the entire practicability of this method of suspension.

A feature of the instrument board worth mentioning is the provision for calibrating the instruments without removing them from the switchboard. This is done by means of so-called calibrating plugs which are accessible from in front of the board, and to which the standard portable instrument may be attached for taking readings.

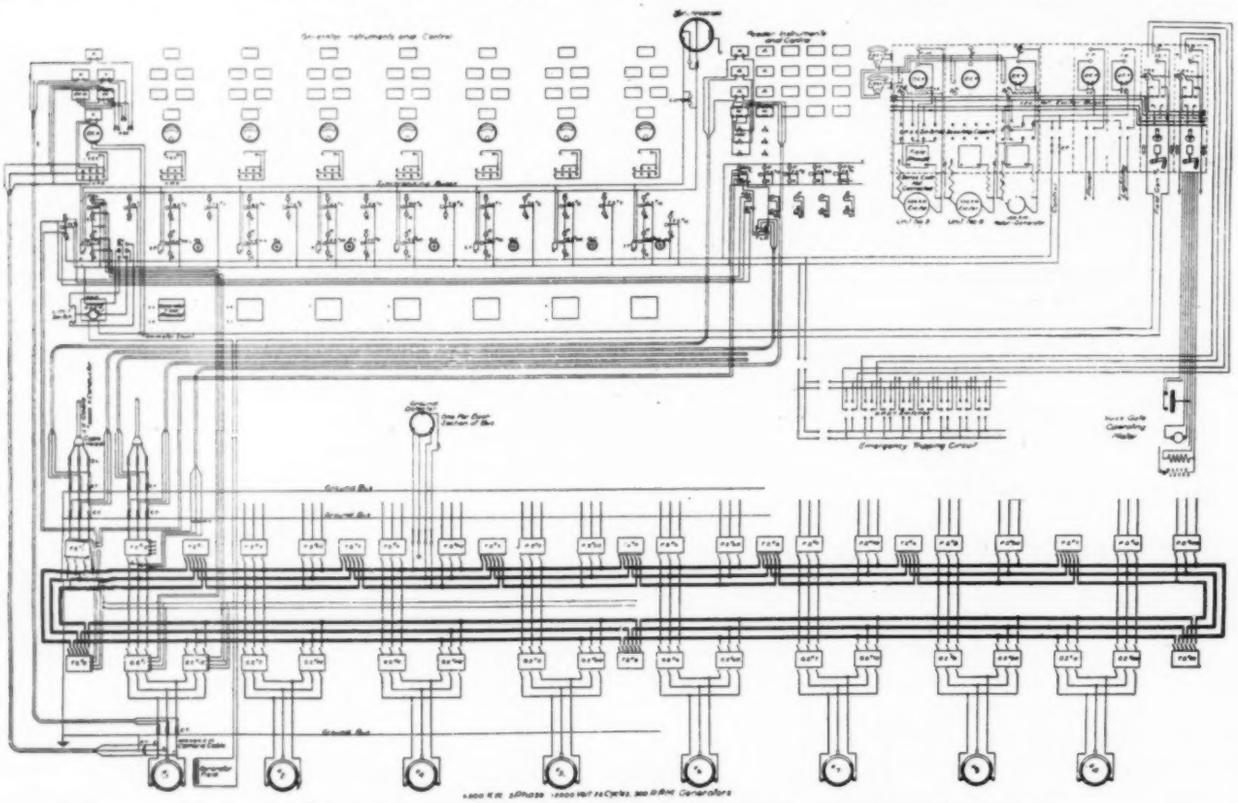


FIG. 13.—ALTERNATING-CURRENT WIRING DIAGRAM OF NIAGARA FALLS STATION NO. 3.

The direct-current side of the station, comprising five 750-volt units, is used to supply power for the manufacture of aluminum. This portion of the station required a design especially suited for unusual conditions, chief among which is the demand for a very large current output, at a fairly high potential.

The exciter system is made up of two water-wheel-driven generators, each of 550 kilowatts capacity, and one 150-kilowatt motor-generator. In addition to supplying field current for the alternators, the exciters supply local power for running hoists and operating valves, also current for lighting the station.

(To be continued.)

Quick Recovery from Station Fire in Philadelphia.

Early Saturday morning, May 6, a serious fire occurred in Station C of the Philadelphia Electric Company. This is one of the chief distributing stations in the central direct-current district.

Through the coolness and efficiency of all concerned the fire was put out and the current cut off, without serious injury or loss of life.

The fire had resulted, however, in the complete shutting down of the station.

Inside of a half hour the entire machinery of a large and efficient organization was put in motion, with the sole idea of furnishing current to all of the customers affected, at the earliest possible moment, and at a minimum of inconvenience to them.

The temporary loss of Station C did not handicap the company from a standpoint of generating capacity, because the main generating stations were not affected and it had established numerous substations throughout the city, all of which are interconnected for the very purpose of supplying continuous service in all districts, even though individual plants should meet with accident or destruction.

In this case, however, hundreds of feeders and cables had their insulation partly destroyed by fire, were covered by a mass of debris, and in all cases were completely flooded by water. This water had to be pumped out before the majority of the cables could be even approached. Fuses in junction boxes throughout the central district had been blown, and the problem to be solved was the disconnecting of all feeders supplied by the affected station which were temporarily rendered useless, and then to reconnect the feeders and mains from the various substations.

It was a gigantic piece of work, but it was done expertly, carefully and with remarkable speed. The record is as follows:

The fire occurred at 5:30 a. m. At 6:30 o'clock the work of disconnecting and removing the tremendous mass of twisted feeders and cables, damaged and useless apparatus was well under way. At 10 o'clock thirty per cent of the affected district was connected. Before noon fifty per cent of the district was connected. By evening all but a very small percentage of the affected district was receiving service approximating the normal. All of the public service institutions and theaters were able to conduct their business and to give their performances without perceptible difference in their lighting equipment. All of the newspapers were published as usual. The municipal lighting service was unaffected, and as a matter of fact seventy-five per cent of the customers would have been unaware, except for newspaper accounts, of the accident which had taken place.

The Philadelphia Electric Company has made the above facts public in a candid advertisement in which it calls attention to this record and contrasts it with the prolonged delay and inconvenience that would have resulted from a similar accident to an isolated plant. It also emphasizes the fact that central-station service means reliability in electric light and power service.

Important Factors Respecting Producer Gas.

In a recent bulletin (No. 7) issued by the Bureau of Mines, Washington, D. C., and entitled "Essential Factors in the Production of Producer Gas," the authors, J. K. Clement, L. H. Adams and C. N. Haskins, bring out some highly interesting points on this subject.

In experiments made by one of the authors at the bureau's experiment station it was found that the temperature in the fuel bed of the gas producer varied greatly in different parts of the bed. In order to ascertain the conditions of temperature most favorable to the efficient operation of the producer, it became necessary to determine the temperature required for the formation of carbon monoxide and hydrogen.

Among other reasons for investigating the conditions for the reduction of carbon dioxide by carbon was that a small quantity of carbon monoxide is invariably contained in the flue gases of boiler furnaces and it was hoped that means might be suggested of preventing its formation and the resulting loss in furnace efficiency.

These investigations demonstrated that a very high temperature is necessary for the production of carbon monoxide from carbon dioxide and carbon. These conditions argue against operating the fuel bed and the gas producer at extremely high temperatures—above 1,300 degrees centigrade.

A very hot fuel bed means that the gases will leave the producer at a high temperature, and thus lower the efficiency of the producer. The gain in capacity would, therefore, be accompanied by a loss in efficiency, unless the heat of the gases could be used for generating steam or preheating the air blast. A high temperature also favors clinkering. In the application of the results of these experiments to commercial producers and furnaces it will be necessary, of course, to consider the other questions which are involved.

Various explanations have been suggested to account for the presence of small amounts of carbon monoxide in the flue gases of boiler furnaces. Perhaps the one generally accepted by engineers is that the oxygen of the air first unites with carbon to form carbon dioxide, and that as this gas passes up through the bed it combines with carbon in accordance with the equation:

$$CO_2+C=2\ CO.$$

Assuming this to be the correct explanation, then the questions to be solved are what conditions favor this reaction and what conditions will tend to retard it. It has been shown by the authors that the higher the velocity of the gas and the thinner the fuel bed the less will be the percentage of carbon monoxide formed. A heavy fuel bed in the boiler furnace would therefore favor the formation of carbon monoxide. Also, the greater the supply of air to a given depth of bed the less would be the percentage of this gas formed; therefore with a hot fuel bed the formation of a small amount of carbon monoxide is inevitable. In order that this carbon monoxide may be burned to carbon dioxide in some way sufficient air must be added to the hot gases as they leave the top of the fuel bed.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ELECTRIC STREET LIGHTING.—VIII.

BY ALBERT SCHEIBLE.

TUNGSTEN POSTS AND DISPLAY STREET LIGHTING.

While the main functions of street lighting have always been path-finding and crime-preventing, the use of electric lights added a display element which in recent years has developed another use of street lights, namely that of attracting the crowds and thereby directing trade to certain blocks or streets. In the early days of arc lighting, those who had the lamps placed at their corners were proud of this dressy touch to their property, while the rivalry of others wanting the same often led to a distribution of lamps according to political influence, instead of having it aim to scatter the light impartially.

During the last six or eight years this business-drawing value of intense outdoor lighting has no longer been accepted as a mere incident of the street illumination, but has been deliberately sought for drawing trade to a block, a street or even a whole town in competition with others. This festive or display street lighting was at first the outgrowth of temporary arches or festoons erected in connection with special celebrations. When continued or duplicated in more permanent form, both the arches and the festoons still differ from the older methods of street lighting in that they are show objects in themselves and hence divert the attention from the adjoining buildings. This obscuring of the buildings is the more effective when reflectors are used over the lamps (which might be advisable in towns having tottering or unsightly buildings) without which reflectors the actual street-lighting value is usually very small in proportion to the amount of current used. However, the really progressive streets in which business men are willing to pay for lighting that will attract trade, generally have buildings of which the merchants are proud and which they are anxious to show.

Moreover, both arches and festoons lack the dignity which should characterize the lighting of a high-class business street and which is attained in the more recent embodiment of the display-lighting tendency in street lighting, the tungsten lamp-post. As a temporary expedient for drawing the public to certain streets, the use of arches or festoons (both of which give the festive, decorative appearance appropriate for temporary lighting) proved a success in many places and helped in the slow process of educating business men to the trade value of more impressive street lighting. But the lack of dignity, the detracting from the buildings and the apparent roofing of the streets into long tunnels, all scored against their permanently solving the merchants' problem.

While arches, festoons and outline lighting (i. e., the outlining of windows, roofs and building contours by closely spaced incandescent lamps) were being tried in this country for display lighting on prominent streets, Europeans were producing their display effects by using arc lamps high above the ground so as to light both the streets and the whole building fronts (as pictured in the issues of April 29 and May 6). Instead of following the European practice in this respect, Americans adopted a compromise in the form of lamp-posts supporting clusters of tungsten lamps, introducing a decorative effect which could not be obtained with the more intense arc lights since the latter, even when placed high, will give an imitation daylight effect having but little decorative value.

During the last few years the introduction of such tungsten lamp-posts (usually with from three to five lamps per post) has been very rapid, though a large share of them have been installed by the merchants themselves and not by the cities. Indeed, in many cases the city instead of at least sharing the expense of such lighting with the merchants has continued its old street lamps in the same blocks, marring the decorative effect obtained from the tungsten clusters. Logically, the city should remove its usual street lamps (posts and all) in blocks where closely spaced tungsten posts are paid for by the merchants and should equalize the expense by contributing the amount saved on the street lamps and by compelling all property owners on the affected streets to share in this expense.

While these post systems as generally installed with closely spaced lamps only ten or twelve feet above the walks have been a decided success both commercially and decoratively, they have usually been wasteful of energy as far as the actual lighting of the streets is concerned, the evident aim being an "ornamental curb lighting" rather than street lighting. Only recently has a movement been started towards distributing the light from such post units more efficiently without detracting from the dignified and decorative appearance of the posts, thus overcoming the undue prominence of the lights themselves which is just as noticeable at night as it is in the photograph on page 1001.

PRESENT TENDENCIES IN STREET LIGHTING.

Any one who may have assumed that in the course of three decades electric street lighting would settle down into fixed ruts, must be surprised at the continued lack of finality in street-lighting methods. The reason for this lies partly in the gradual and not yet ended development of new lighting units and of more advantageous methods of distributing both the light and the current needed for producing it; partly also, in the time required for educating the general public to the wisdom of paying for really adequate street lighting. So slowly have these processes

been evolving, that even now after over thirty years of electric street lighting we are still confronted with a variety of serious problems, in connection with which certain tendencies are worth noting:

(1) *Higher Intensity of Illumination.*—That of the moon in its second or third quarter used to be thought ideal, but has gradually been raised until now nothing less than an intensity equal to that of average daylight is advocated by many for important business streets.

(2) *Basis of Lighting Contracts.*—In spite of the lessons taught by the famous Colorado Springs controversy and its more recent Wisconsin counterpart, the making of street-lighting contracts is still in a somewhat chaotic state. Opinions still differ as to how and where the resulting illumination should be measured and contracts are usually based on the maintaining of lamps of given makes and types under certain working conditions.

(3) *Placing the Lamps Effectively.*—Many, though not all, of our large cities have already learned how to differentiate between the size and spacing of units for different classes of streets. To do this effectively and indeed to plan the whole street lighting for a city of any size wisely, requires an experience and ability far beyond that of the average political incumbent. It will be interesting to note what effect the commission form of city government, which is so rapidly growing in popularity, will have in securing a higher grade of experts to plan and supervise the street lighting.

(4) *Business Display Lighting.*—Now that the merchants in so many cities have taken hold of a part of the lighting problem, usually at their own expense, there will be less and less overlooking of the business importance of the main streets in planning the lighting for the same; also less conflict between the city street lamps and any display lighting for which the merchants themselves are paying. Indeed, the time seems not far off when the more impressive street lighting demanded for certain sections of a city, like the more satisfactory pavements, will no longer be paid by voluntary contributions in which some decline to join, but by evenly distributed special assessments.

(5) *Reflecting Surfaces.*—Instead of depending entirely on the direct radiation of the light, some American cities are already following the European plan of utilizing the light reflected from building fronts by lamps placed forty or fifty feet high, thereby producing almost daylight effects on busy streets. Moreover, since our discerning of dimly lighted objects is made easier by their being silhouetted against a lighter background (such as a macadamized street lighted from a distant lamp), the reflecting power of the roadways themselves may need to be considered in choosing paving materials to increase the effectiveness of the street lighting.

(6) *Distribution Methods.*—Owing to the low power factor of the mercury rectifier, its persistent use beyond the present decade may be open to question, there being already a marked tendency towards substituting alternating current for direct-current arc lamps. So also, the proposal for lighting Chicago streets from series 7.5-ampere alternating circuits by means of individual series transformers stepping the current up to ten amperes (thereby keeping the circuit intact in case the current is opened in any lamp) may mark a new departure in the methods of distribution. Again, the fact that arc lamps of low amperage (such as the four-ampere arcs, towards which there has been a strong tendency during recent years) have a much lower luminous efficiency in both the metallic-oxide (magnetite) and the impregnated-carbon (flaming arc) lamps, is already tending towards the substitution of arcs of higher amperage.

(7) *Increased Height of Street Lamps.*—Many of our larger cities are learning that the only way to avoid the gloomy, tunnel-like effect produced by low lamps on streets having tall buildings is to raise the lamps some forty or fifty feet above the ground, lighting at least the lower four or five stories of the adjoining building fronts.

(8) *Attitude of Central Stations.*—Street lighting is no longer the economic factor which it was in the early days of electric lighting when the encouragement and definite revenue from the street lighting enabled hundreds of electric light plants to get their start. A large share of these found that their allowances for repairs and depreciation were far from adequate and that the lighting of the streets at the contract prices gave them little, if any, profit. Some rebelled, only to have municipal lighting plants installed with the resulting wonderful reports of alleged savings in the cost of lighting, which reports reflected on the competent central-station managers who would not dream of misleading their backers in the way that so many city lighting plants have misled the people of their towns. To avoid such a demoralization, a great many central stations are today supplying street lights at little or no profit, rendering an effective service to their communities by so doing and counting on the commercial patronage to compensate them.

All told, the present tendencies and the numerous experiments which they will involve during the coming years will continue to make the whole subject of electric street lighting an exceedingly interesting one and one which deserves the careful attention not only of the electrical fraternity and of municipal officials, but also of every man who has the welfare of his city seriously at heart.

(The End.)

New York Section, Illuminating Engineering Society.

At the meeting of the New York Section of the Illuminating Engineering Society held on Thursday evening, May 11, Dr. R. S. Woodworth, professor of psychology at Columbia University, made an interesting address on the subject: "Psychology of Light."

Dr. Woodworth stated that since sensations of light and color can be arranged in three ways, namely, according to color-tone, brightness and saturation, it is natural to attempt a synthesis of all three sorts of arrangement into some composite scheme. No two-dimensional scheme will accomplish this synthesis, but it is possible to do it in three dimensions. If all the color-tones which agree in brightness and in saturation are first arranged around the circumference of a circle, a gray of the same brightness may be located at the center of the circle, and along each radius may be arranged the saturation series of a given color, grading from neutral gray to the greatest saturation occurring at the given brightness. Thus the plane of the circle will contain all the colors, including gray, which have the same brightness. Similarly, in another plane, we may construct another color circle of another brightness, with its corresponding gray and saturation series. By proceeding in this way and piling the planes in the order of brightness, with the corresponding color-tones always in corresponding positions on the various circles, we finally will include all possible sensations of light and color in a single three-dimensional scheme, which may take the form of a cylinder, bright on top and dark beneath, gray at the center and saturated on the outside, red along one element of the convex surface and blue along another.

Starting out from the three-dimensional system of sensations of light, we naturally inquire next as to the corresponding dimensions of the physical stimulus. But we are

soon brought to the conviction that there are no dimensions of the stimulus corresponding precisely to the scales of color-tone, brightness and saturation. In a rough and general way, we find that the scale of color corresponds to the scale of wave-length, the scale of brightness to the scale of intensity or energy of the stimulus, and the scale of saturation to the degree of purity of a single wave-length as contrasted with the admixture of other wave-lengths. Thus, light having a wave-length of 700 millionths of a millimeter and thereabouts gives the sensation of red, light of 589 millionths gives the sodium yellow, etc.; light of small physical energy gives a dark color, while light of great intensity gives a bright color; light that is homogeneous or monochromatic or, in other words, all of one wave-length, gives a saturated impression, while light compounded of rays in various lengths gives an unsaturated color or even a neutral gray or white.

In a general way, color-tone depends on the wave-length, but there are many important exceptions to the rule. Just as prolonged fixation of a colored light changes its apparent saturation, it may also change its apparent color. A light which appears orange or greenish yellow at first, tends on prolonged fixation to change toward pure yellow, at the same time losing in saturation; and, similarly, a greenish blue or violet changes towards blue. Yellow and blue themselves do not change except in saturation; and there are a particular bluish green and a particular purplish red which, also, do not change in color, but only lose rapidly in saturation, verging towards neutral gray.

In opening the discussion, Chairman A. H. Elliott said that, with the advancement of knowledge as regards the application of light, it is appreciated more and more that the eye is the one thing which should receive consideration beyond everything else, and these opinions give rise to an appreciation of the physiology, psychology and esthetics in making use of this medium.

F. L. Godinez expressed the opinion that opthalmologists are beginning to realize the importance of observing those conditions that have a direct bearing on differentiation between physiological and psychological influences. A record is made in each case of the patient, and the observations that are noted generally might be covered under about ten headings: age, occupation, color, sex, characteristics of the patient, historical and hereditary conditions, inspection of the cornea, conjunctiva, and muscular tension, and examination of the pupil, which has all been done practically by external inspection. Then there is considered visual improvement by adding lenses, and after that tests are made by the opthalmometer and the ophthalmoscope. Measurements are also made of the Murck balance, and a record is made of both visual fields. This is followed by tests of color sensitivity and an examination of refraction after nine days' use of a mydriatic and finally by a record of the lenses and treatment prescribed. It will be noted that no consecutive record appears regarding the illumination conditions which the patient has been subjected to from childhood both at home and in his office.

Prof. S. W. Ashe said he was pleased to note that Dr. Woodworth's paper indicated a convincing proof as to the accuracy of the flicker photometer. He asked whether in the direct-comparison method of comparing two lights the element of fatigue ever affects the conclusions.

E. L. Elliott stated that the object of light, so far as the illuminating engineer is concerned, is to see, and that illumination is best which enables him to see best the particular thing which he wants to see—hence the so-called acuity of vision photometers are in effect the only practical ones from the illuminating engineer's standpoint. He also referred to some recent experiments on color work, by Dr. Peter Cooper Hewitt.

Dr. A. S. McAllister spoke of the difference between the physicist and the physiologist in color work. It seems to him that there cannot possibly be an agreement between them.

Mr. Rice stated that the objection to visual-acuity photometers is, that while they measure visual acuity, they do not measure intensity of light. There are two different factors entering into the problem, the ability to see under different colors of light and the comparative intensity.

The element of glare is one which enters into this very largely. Lights in which there is a predominance of green and blue wave-lengths show more glare than there is with the red.

Dr. A. H. Elliott declared that the psychological side of this matter is a most practical one, and one which we can use in our every day work in the application of light to a far greater extent than we might perhaps at first realize. The conditions of feeling, tone and atmosphere may not be elements which would appeal to the purely mechanically inclined designers of lighting installations, yet it is a fact that these things have more meaning and stand for much more in the application of light than saying that there is such an intensity of foot-candles or so many effective lumens per watt in any installation. There is probably no place where the psychology of lighting is a more important factor than in the lighting of the home. It is a comparatively easy matter to so design the lighting in the living room that when the husband arrives from his work he is either met with a repellant force, something to keep his nerves on edge, or else he is greeted with a condition which induces relaxation. He felt that the gas industry has made an important achievement by its use of amber mantles, and that the day is probably not far distant when our incandescent lamps will be put out in such form that they will give rise to similar conditions.

Dr. Woodworth closed the discussion by referring at some length to color-blindness. Comparatively very few people are totally color-blind, although partial color-blindness is quite common. There is some doubt whether women are less frequently color-blind than men, as is generally stated. Regarding fatigue in photometry, the theory is that with red and green processes the eye is more readily fatigued than in the case of yellow and blue. Fatigue is least with the white and black, with the yellow and blue following, and then comes finally the red and green.

An Artistic Electric Sign.

There has recently been completed in Boston an attractive electric sign to advertise the Edison Electric Illuminating Company of Boston. The sign is 25 by 16 feet and represents an immense incandescent bulb in which there is a statue of a Greek godess. The statue stands sixteen feet and has ninety-three square feet of plate glass in the background. At night the figure stands as a dark object in moving clouds, and appears gradually to come out in a burst of light. The words "Power" and "Light" around the border then flash on. The sign is said to be one of the most artistic electric signs in the world.

Utah Society of Engineers.

The Utah Society of Engineers held its regular monthly meeting on Friday evening, May 19, at the University of Utah. The paper of the evening was by George M. Bacon, and was entitled "Notes on the Construction of a Large Concrete Diverting Dam." The newly elected president, M. D. Grosh, delivered his inaugural address.

Ornamental Tungsten Street Lamps in Grand Forks, N. D.

The movement for the ornamental lighting of important streets, which has been so general in all parts of the country, has usually found its chief financial support from merchants and property owners along the streets specially illuminated. In many cities there is now developing a feeling that the municipal government should assume this burden because the public and the city at large receive the chief benefits. Some cities, in fact, have paid for their ornamental lighting installations as soon as put in. Among these is Grand Forks, N. D.

Grand Forks is a rapidly growing city and has become one of the most progressive centers in the Northwest. Realizing the artistic, commercial and protective value of well lighted streets, the municipal authorities arranged to illuminate the principal thoroughfares with clusters of tungsten lamps mounted on handsome standards. A total of 132 of these has been installed. Each bears four sixty-watt pendent lamps and one 100-watt upright lamp in the center. The pendent lamps are inclosed in twelve-inch opalescent globes and the upright lamp in a sixteen-inch globe.

TUNGSTEN STREET LIGHTING IN GRAND FORKS.

The standards are spaced evenly and so as to have eight or ten to each block, depending on the length of the block. Seventeen blocks in the city's business district are equipped with the new lights. The streets so lighted are: Third Street between Belmont and Cheyenne Avenues, Fourth Street between Alpha and Kittson Avenues, De Mirs Avenue from the Red River to the Great Northern passenger depot, and Kittson Avenue between Third and Fifth Streets. The total cost of the equipment complete was $29,560. The installation has met with enthusiastic popularity.

Commercial Section, National Electric Light Association.

Reference has been made in these columns in previous issues to the organization of the Commercial Section of the National Electric Light Association and to some of the advantages that membership in it confers. In a nutshell it may be said that the Commercial Section has been organized by the most progressive men in the commercial departments of the central-station industry and includes also representatives of the manufacturers that supply all kinds of electrical appliances for use on the premises of central-station customers. Its object is to further in every legitimate way the extension of central-station electric service.

The present membership of the Commercial Section is nearly 700. New applications are arriving in nearly every mail, and it is the ambition of the Membership Committee to reach the thousand mark, if possible, before the New York convention, May 29 to June 2, as there are surely a sufficient number of eligible persons to bring the roster up to that number without urging any one whose own interests should not make him want to belong to this section.

The convention reports of the various commercial committees promise to exceed in interest and value, anything of the kind which has ever been presented before the National Electric Light Association.

The Power Committee has been working hard on the compilation of data relative to the power conditions in the different sections of the country. A long list of machinery together with the horsepower of the motors required to drive such machinery, has also been compiled.

The chairman of the Ornamental Street-lighting Committee states that the central stations throughout the country have answered questions put to them on this subject promptly, and that the committee's report will be of great value to all members of the Commercial Section.

The Residence Business Committee will present a number of interesting features in its report, including plans and blue-prints showing a complete scheme of wiring recommended for residences, for power and cooking as well as for lighting; also plans and recommendations for keeping track of this business.

The report of the Committee on Electricity in Rural Districts will comprise a large number of illustrations showing the various applications of electricity in rural communities and the excellent prospects in this line.

The Sign Committee has prepared a bulletin which should be an agreeable surprise to members of the Commercial Section, all of whom will receive it.

The Advertising Committee has a very important proposition to bring before the Commercial Section regarding the exchange of central-station advertising.

All of these reports, publications, etc., form a mass of information which will be of inestimable value to anyone belonging to the Commercial Section. The advantages of joining now, before the convention meets, are therefore apparent. J. Robert Crouse, 1823 East Forty-fifth street, Cleveland, O., is chairman of the Membership Committee.

Extension of Telephone Train Dispatching in Kansas.

According to officials of the Chicago, Rock Island & Pacific Railroad, telephones will be used in receiving and transmitting orders of the Kansas division of that railroad after September 1. Dispatchers now handle a part of the movement of trains on the Kansas division by telephone, but a portion of the work is still done by the old system. Workmen have commenced to string wires from Belleville to Caldwell, a distance of 275 miles, and when this stretch is completed, the entire Kansas division will be served by telephone.

TELEPHONY—TELEGRAPHY, and WIRELESS.

Practical Aspects of Printing Telegraphy.

An important paper on this subject was presented before the Institution of Electrical Engineers, London, England, on May 4. The author, Donald Murray, is the inventor of what are known as the Murray automatic and Murray multiplex printing telegraphs. In this paper he gives the results of extended experience in overcoming obstacles, physical and otherwise, to the introduction of printing telegraphy. The paper is quite comprehensive and takes up in its three parts a discussion of the field for printing telegraphy, the difficulties in the way of its general introduction and a description of the author's systems. Although it dwells particularly on conditions existing in the British Isles, the paper is of universal interest to telegraph and telephone engineers. On account of its great length, covering sixty-six closely printed pages, space does not permit giving more than a summary of the most important points touched on.

Part I discusses the field for printing telegraphy, and it is shown that there is little scope at present for printing telegraphs in wireless work, in railway telegraph traffic, or on long ocean cables. Their use is chiefly in connection with land telegraph lines between large centers of population, and it is shown that printing telegraphs will, in the future, perform a very important service in assisting the co-operation between telegraph and telephone. It is admitted that for transmission of intelligence over short distances the telephone stands unrivalled; but it is contended that for the transmission of intelligence over considerable distances the most efficient arrangement is a combination of the telephone and telegraph, the telephone acting as the collector and distributor for long telegraph lines. The reason is that the cost of long telephone lines is very great, while the labor cost of a telephone conversation is extremely small and the time saving is great. With the telegraph, on the other hand, the cost of the line is less than one-quarter of the cost of a telephone line; but the telegraph labor cost is very heavy and there is much loss of time. By co-operation between the telegraph and telephone the advantage of the cheap telegraph line is combined with the advantage of the low labor cost and time saving of the telephone. It is therefore contended that economic necessity will in future lead to a great increase in telephone-telegrams, or, as the British Post Office already calls them, "phonograms." Printing telegraphs will form essential links in the telephone-telegraph network, because printing telegraphs are the only means by which the carrying capacity of telegraph lines can be greatly increased and the labor cost at the same time decreased.

Part II is a long and detailed account of the difficulties that have been encountered in connection with the development and practical application of printing telegraphs. With the idea of forming a historical record of these difficulties, they have been fully and minutely described. It is pointed out in the first place that the saving of labor by the use of printing telegraphs cannot in the nature of things be very great; but that there is reasonable ground for expecting to save from twenty-five to fifty per cent in labor compared with the Morse key and sounder. The obstacles encountered in dealing with both commercial and press messages are discussed.

The difficulties in the way of making a copy for record of telegrams delivered are explained, and it is pointed out that wet-press copying is the only practical method of retaining copies of telegraph messages when printing telegraphs are used. The necessity for keeping copies of telegrams at all is not quite obvious.

When page-printing telegraphs are used a change is necessary in the telegraph forms used by various administrations. There are two kinds of telegraph messages, those sent from city *A* to be delivered in city *B*, and those sent from city *A* to be retransmitted in city *B* to city *C*. In city *B* nearly all telegraph administrations use two different kinds of telegraph forms to distinguish these two kinds of messages. For a page-printing telegraph only one form for both kinds of messages is possible.

Numbering telegraph messages presented some difficulties in England when the Murray automatic printing telegraph system was introduced. Counting the number of words in telegrams is a serious burden. There are so many Siamese twin words that are neither one nor two, that counting words is difficult, and the necessity for careful checking and counting considerably diminishes the number of telegrams that it is possible to transmit per hour. It also increases the labor cost. If it were possible to charge for telegrams in some way by time as in the case of the telephone, instead of by words, a lot of delay and labor would be saved.

Errors in telegrams, due to the telegraph line, to the telegraph machinery, and to the human operator impose very serious limitations on the time and labor saving possible with printing telegraphs.

The variety of telegraph messages and the irregularity in the flow of telegraph traffic also greatly reduce the possible time and labor saving.

Traffic arrangements and hours of duty of operators are necessarily of a very complicated character in the case of large telegraph administrations, and the introduction of printing telegraphs leads to considerable variation of these arrangements. It is difficult to introduce changes in the daily routine of large numbers of human beings. Of course, in the case of France, Germany, and other countries on the Continent, where the Hughes system has been largely employed for more than a quar-

ter of a century, such difficulties have long since adjusted themselves. It is in the Morse key and sounder countries that the introduction of printing telegraphs necessitates some changes of routine.

International telegraph traffic presents special difficulties because of the division of authority and difference in habits and ideas and customs and differences in language.

Alphabetical troubles are not the least that printing-telegraph inventors have to encounter. Each country requires some variation in the telegraphic alphabet, and it appears to be a physical impossibility to devise a printing telegraph that will suit all languages. A curious illustration of this alphabetical difficulty is the confusion that exists in Great Britain through the use of the oblique stroke both for money and fractions. 3/8 may be read as 3s. 8d. or as three-eighths. This confusion has led to monetary loss.

Code and cipher messages are the despair of telegraph administrations, but on the whole a good printing telegraph can handle such messages with less risk of error than the Morse key and sounder, and at least as expeditiously if proper methods are used. The essential condition is careful training of operators in working on typewriter keyboards without looking at the keys.

The use of envelopes and the addressing of telegrams present difficulties in the case of page-printing telegraphs. On the Continent envelopes are not used, and the telegrams have to be folded up in special ways varying with each administration. The printing of the messages must suit these methods of folding. This requirement is hard to fullfil in the case of a page-printing telegraph.

Finally, there are mechanical difficulties of construction. Printing telegraph machines belong to a theoretically bad group of mechanisms, in which the majority of the actions are striking instead of sliding or rolling, and it is only by close attention to details that success has been achieved.

Part III gives a brief general description of the Murray automatic system and a more extended description of the new Murray multiplex system as an illustration of some methods by which it has been attempted to save time, line, and labor in telegraphy and to overcome troubles noted in Part II.

These two systems have been designed to work together as one whole, the automatic system being best suited for long lines, and the multiplex for lines of average length. The two systems are in a sense complementary to each other. Many of the instruments are the same in both systems and are interchangeable, the same alphabet or code of signals—the five-unit Baudot—is used in both, and the perforated tape is the same in both systems, so that a perforated-tape message may be transmitted either over a Murray automatic or a Murray multiplex circuit, and it may be reproduced and retransmitted at the receiving station on either system. An important point is that the same keyboard perforator is used on both systems. The standard typewriter arrangement of the keys is followed on the keyboard, and the same characters are used in both systems.

In the Murray automatic system, the messages are first perforated on a strip of paper tape in the Baudot five-unit alphabet. The perforated tape is then used to transmit the messages by means of an automatic transmitter working on the principle of the Jacquard loom. The speed of transmission of the signals is from 100 to 180 words (600 to 1,080 letters) a minute, and at the receiving station the arriving signals are recorded at the same speed as perforations in a second paper tape, which is an exact replica of the transmitting tape. This reproduced tape at the receiving station then serves to operate an automatic typewriter somewhat on the principle of a mechanical piano. The telegraph line is worked duplex, giving one transmission in each direction simultaneously on the one wire. The received messages are printed in Roman type in page form, at speeds ranging up to about 200 words a minute (twenty letters a second).

In order to prevent interruption of traffic by any stoppage of the apparatus, it is necessary to have reserve machines. With an automatic system this means duplicating the whole of the apparatus. The result is that the Murray automatic system is very expensive, costing at present about $6,000 per circuit, exclusive of royalties. This is a very serious handicap on the use of the Murray automatic. If manufactured in large quantities the cost would come down to about half this amount, but under present telegraph conditions the field for a printing telegraph of this kind is not sufficiently large to require large quantities of the apparatus.

Taking the four factors already referred to, namely, saving of time, labor, line, and office equipment, the Murray automatic system shows to advantage only in respect of saving of line. The cost of office equipment is greater than with the Murray multiplex, there is less saving of labor than with the multiplex, and there may be loss of time if the working arrangements are not good. This is specially the case if the system is worked at a high speed to carry heavy traffic. The working organization in this case must be first-class, or there will be a great reduction in the carrying capacity of the system. On long lines, 1,000 miles and over, the saving of time and labor are of much less importance than an increase in carrying capacity of the line, provided always that telegraph traffic is growing rapidly so as to render increase of carrying capacity important. It is in such conditions that the Murray automatic has decided advantages, as follows:

1. The alphabet or code of signals that it employs, and the manner of employing it, result in less signaling time per letter than in the case of any other system.

2. Synchronism is not employed, only isochronism. That is to say, phase is of no importance, but the speed must be right.

3. Governing or control of speed is very quick, so that the right speed is obtained in half a second, and is reestablished in half a second if it is momentarily thrown out by a line disturbance.

4. The Murray automatic apparatus is simple—much simpler than any multiplex system.

5. It works very well through the simplest of all repeating stations, namely, the Wheatstone duplex.

6. It works very well and easily with the duplex balance, even on very long lines.

It will be noticed also that the advantages just enumerated are chiefly advantages for working over long lines. Hardly any of them are of importance on short lines. On lines of moderate length, time and labor saving are the all-important factors, and line saving is quite subordinate. On such lines no automatic system can save so much time and labor as a multiplex system. The splitting up of the line into from

four to eight channels greatly facilitates the handling of traffic. There is less delay on messages, while inquiries and corrections are quickly obtained because of the numerous channels over which inquiries can be made. The speed of each channel being comparative low, one operator on each sending channel can perforate tape, and attend to his own automatic transmitter. That saves labor compared with the automatic system. Also at the receiving end of the line, the speed of each channel being low, thirty to fifty words a minute, the printers can print direct, and can be made entirely automatic in their actions, thereby saving labor, because one receiving operator can then receive and check as many as 150 messages an hour. On the other hand, on a long line it is not possible to get a number of multiplex channels. Hence on long lines the multiplex loses its chief advantage over the automatic system, and the advantages of the automatic system, already mentioned, then predominate.

On lines not too long to prevent a number of channels being obtained with a multiplex system on one line, the multiplex has the advantage that it can give simultaneous independent channels of communication between several towns connected by a single telegraph wire. This is an arrangement of great practical importance in the case of several towns, none of which alone can keep a telegraph line fully occupied. With an automatic system such an arrangement is not possible. With the automatic system messages may be retransmitted automatically by the received tape, so that various centers can be connected up in this way on one line, but this would only be practicable on long lines connecting important centers. The Murray multiplex, however, now possesses this advantage of being able to retransmit messages from perforated receiving tape.

Although the relative advantages and disadvantages of automatic and multiplex printing telegraphs appear to be obvious and are now tolerably familiar to telegraph engineers, this knowledge has only been gradually accumulated during the past few years as the result of prolonged trials of various automatic and multiplex printing telegraphs. The British and German Administrations especially have carried out a very large amount of experimental work with various telegraph systems, including the Murray automatic telegraph.

The idea of combining the advantages of the automatic and multiplex systems led to the development of the Murray multiplex printing telegraph. It is only about a year since this system passed out of the laboratory stage and arrived at practical success. The Murray automatic system may be said to be based on the Wheatstone automatic transmitter. The Murray automatic transmitter is greatly modified, but the essential principles of the Wheatstone transmitter are embodied in it. In a multiplex system the instrument corresponding to the Wheatstone automatic transmitter is the distributor, and the Murray multiplex system may similarly be said to be founded on the Baudot, because it has taken the Baudot distributor as its basis. For driving the distributors, however, instead of the Baudot arrangement, the Delaney multiplex plan of using the Lacour phonic wheel motor is adopted. Apart from the distributors, the only resemblance between the Baudot and the Murray multiplex is in general principles and in the use of the Baudot alphabet. The Murray multiplex transmitting and printing machines closely resemble the corresponding Murray automatic instruments. Many are indeed identical. The normal speed of the Baudot is thirty words a minute for each transmission. In the Murray multiplex the speed is raised to forty words a minute, in order to increase the efficiency of the labor at both ends of the line. It is possible that under certain conditions it may prove advantageous to increase the speed still further to forty-five or fifty or even sixty words a minute. There are considerable possibilities of both capital and labor saving by such increased speed, and the Murray multiplex has the advantage of easy adjustment of speed over a considerable range from twenty up to forty-five, and possibly sixty or more words a minute for each transmission or channel.

Like the Baudot and similar systems, the Murray multiplex printing telegraph divides up the line time so as to give several transmissions or channels on one telegraph wire, each at a comparatively low speed suitable for the work of one operator sending and one receiving. Two distributors, identical in design, are employed, one at each end of the telegraph line (station *A* and station *B*). The distributor at station *A* sends out a governing impulse once for each revolution of the contact arm (four revolutions per second for forty words a minute). This impulse controls the speed and phase of the distributor at station *B* so as to keep it running in synchronism with the distributor at station *A*. This instrument is a "double," giving two simultaneous transmissions working simplex and four when working duplex. The new system may also be worked "triple" or "quadruple," the duplex balance in these cases giving six or eight transmissions simultaneously on one line. Special arrangements have been designed to give up to six transmissions in each direction, but it seems unlikely that anything more than quadruple duplex (eight transmissions) will ever be required in practice.

The distributor brush arms are carried directly on the spindle of a phonic wheel motor, which is identical in all respects with the phonic wheel motor employed in the Murray automatic system, and it is driven in the same way by a vibrating reed. There are no gear wheels or governing mechanisms. The commutator and contact arms and brushes are the same as in the Baudot, and the adjustments are the same. The distributor fits on to a wooden base provided with spring contact terminals, so that the machine may be instantly lifted off or replaced. The distributor will work perfectly in conjunction with Baudot distributors and other Baudot apparatus. It has the advantage over the Baudot of being simpler, cheaper, and easier to construct. On the other hand, where Baudot distributors are already in use, the Murray multiplex transmitting and printing mechanisms will work excellently with the Baudot distributors. The Baudot commutator and revolving brush arms take the place of the automatic transmitter driven by the same phonic wheel motor in the Murray automatic system. The Murray multiplex, in fact, combines many features of the Murray automatic and of the Baudot, and a considerable portion of the apparatus, with slight modifications, is interchangeable in all three systems.

It is too early yet to say positively what results can be obtained with the new Murray multiplex system, especially as there are still a number of detail improvements to be made. A complete installation has only recently been

completed for the British Post Office, and is now being installed between London and Manchester. Prior to this, an experimental set, giving one transmission only, was made by the British Post Office, and tried for about six months between London and Birmingham. The results were surprisingly good. The sending operators were two girls without previous experience on typewriter keyboards, and yet within one month they were each punching from forty to forty-five messages an hour. After about three months' practice each of these two girls succeeded in perforating 100 messages in one hour. Excluding several days when there were interruptions and breakdowns due to imperfections in the experimental apparatus, and excluding several days when traffic was light, the average number of messages on the one channel or transmission of the multiplex was over eighty per hour. On several days during busy hours the average exceeded 100 messages an hour. On one day, for instance, during three consecutive hours from 10 a. m. to 1 p. m., the numbers were 104, 126, and 102 messages per hour.

Indiana Independent Telephone Convention.

In calling the sixth annual convention of the Indiana Independent Telephone Association to order at Indianapolis, May 10, President N. G. Hunter declared that independent telephone interests are firmly established in Indiana. He congratulated the association on the good attendance and said the membership had been increased fifty per cent during the year. He said the recent opening of the toll system under the independent lines connecting Indiana, Illinois, Michigan, Wisconsin, and other states was one of the important steps taken during the past year. The connections thus made with the independent lines gives 2,000,000 subscribers direct toll connection.

Governor Marshall welcomed the delegates to the city. He said that the maintenance of two telephone plants where one could serve the public is a burden that should no longer be tolerated. He said the State should regulate the rate for such service and not allow a competing or duplicate company to come into territory already occupied. He urged that the telephone interests be consolidated and regulated under a wise commission law and admonished the telephone men present to get ready for such a condition of affairs.

An interesting and instructive paper was read by E. V. Hanes, of Indianapolis, on "Advantages of the Toll Clearing House," now in operation in the State.

The subsequent sessions of the convention were almost wholly given up to the discussion of State control of public utilities. This discussion was opened by an address by James Garrard, of Vincennes.

A hearty discussion of this subject was brought out by Mr. Garrard's address and the sentiment was strong for a public-service commission. The president was directed by resolution to appoint a committee to draft a public utilities bill and present the same to the next Legislature for passage.

A radical change was made in the by-laws of the Association, whereby it is made possible for independently owned companies to become members of the Association, although they have working connection with the Bell Company. Heretofore such companies were barred. This conciliatory action is expected to bring nearly all of the 500 independent companies in the State into the Association.

The election of officers resulted in the re-election of N. G. Hunter, of Wabash, president, and Walter Uhl, of Logansport, secretary.

The convention concluded with a very enjoyable banquet.

Wireless in the Arctic Regions.

The Norwegian government has decided to establish a wireless telegraph station in Spitzbergen in the Polar Sea in addition to that already designed for Hammerfest in the extreme north of Norway. This will carry communication 800 miles nearer to the North Pole, and may prove very valuable to future Arctic explorers, who, by carrying wireless apparatus, may keep in touch with civilization.

Wireless in Spain.

King Alfonso has inaugurated a military wireless telegraph station in the military camp of Carabanchel, a few miles outside of Madrid. It is the first powerful wireless station worked in Spain, and the contractors guarantee a range extending to 500 kilometers beyond any point of the Spanish coast, though the effective range will probably reach 4,000 kilometers. Several commercial stations are being built by a Spanish company.

Telephone Train Dispatching.

O. K. Heyer read a paper on telephone train dispatching before the Telephone Society of Boston on April 28. He traced the early history of train dispatching from the time that running ahead of the train with a flag was the method employed, up to the present day. As early as 1883 the telephone was employed for dispatching trains on a few small railroads, but it was not until 1907 that the improvements in telephonic apparatus made possible the wide spread of this method, supplanting the telegraph for this important service.

Mr. Heyer said that the extent to which the telephone has been adopted by the railroads is best shown by the following list of roads, each having telephone circuits covering 1,000 miles of line. These figures include in most cases equipment installed and under construction, both on train and message circuits:

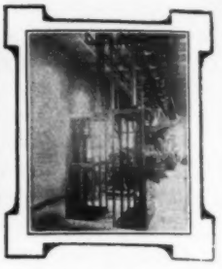
	Miles
Atchison, Topeka & Santa Fe	7,000
Lake Shore & Michigan Southern	2,300
Pennsylvania (east of Pittsburg)	1,700
New York Central (including Boston & Albany)	1,255
Big Four	2,500
Illinois Central	2,259
Canadian Pacific	3,782
Great Northern	3,000
Chicago, Milwaukee & St. Paul	1,800
Louisville & Nashville	2,200
Northern Pacific	1,153
Chicago, Burlington & Quincy	2,700
Seaboard Air Line	1,161
Total	32,810

In addition to these there are sixty which have one or more telephone train-dispatching circuits in operation, the total number of roads being seventy-three and the mileage covered approximately 48,000 out of a total of 285,000 miles of railroads in United States and Canada. Of the railroads that have installed telephone and selector equipment over practically their entire systems, the Lackawanna is the largest. This road, out of a total of 957 miles, has equipped 933, on which there are 271 stations.

Government Telephone System for Argentina.

The Congress of the Argentine Republic has passed a law authorizing the appointment of a commission to investigate and report at the next session of Congress as to the advisability of establishing, under Federal direction, a telephone system throughout the Republic.

Industrial Power



Production of Pig Iron by Electricity.

Consul Stuart J. Fuller, of Gothenburg, Sweden, reports that on November 15, 1910, the Swedish government commenced operations in the experimental production of pig iron by electricity on a scale sufficiently large to be considered of commercial magnitude and to approximate closely the conditions of actual commercial manufacture. Without good coal, and facing a rapid diminution in the supply of wood available for charcoal, the Swedish iron industry has felt that its salvation lies in smelting with the cheap electric energy developed from the country's abundant water power.

A contract was entered into with the directorate of the water power at Trollhatten to take 3,000 horsepower per annum for three years at $2,680 per year. The installation is designed to produce about twenty tons of pig iron every twenty-four hours or, with continuous operation, 7,300 tons per annum.

The utmost secrecy prevails regarding the operations, and no official news of the results is expected for some months. The local press, however, has stated that the operations of the experimental plant have completely fulfilled all expectations and have proved that ore can be electrically reduced with a saving of two thirds of the coal used in the old-style blast furnaces.

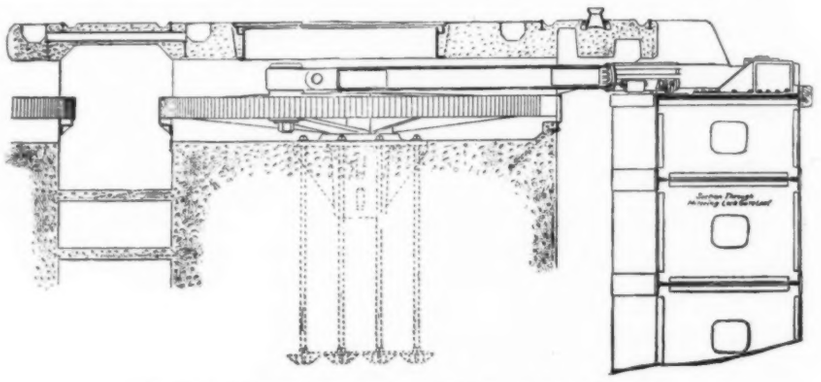
There seems to be a feeling among iron manufacturers that the experiments are proving the practicability of the process, and it is reported that other furnaces are being planned. It is hoped that by the end of 1911 there will be at least four electrical blast furnaces in operation, producing at the rate of 30,000 to 35,000 tons of pig iron per year on a consumption of 12,000 electric horsepower.

It is reported that tests have been made of the Trollhatten electric pig iron at a mill in Lotorp. These tests proved that the iron intended for wire rope is of even and good quality.

Lock-Gate Operating Machines for Panama Canal.

Bids have been requested in the United States for the machinery to operate the lock gates in the Panama Canal. It consists of three distinct parts—the machinery for opening and closing the gates, the machines for locking the gates when they are closed, and the motors to operate these machines.

The machinery for opening and closing the gates was invented in the office of the assistant chief engineer by Edward Schildhauer, electrical and mechanical engineer, and a patent has been issued on it. It is the subject of the illustration herewith. It consists essentially of a crank or "bull wheel" to which is fastened one end of a strut or connecting rod, the other end of which is fastened to a lock gate. The wheel, moved through an arc of 197 degrees, closes or opens the gate leaf, according to the direction in which it is turned. One operation takes two minutes. It is a combination gear and crank, is constructed of cast steel, is nineteen feet two inches in diameter, and weighs approximately 35,000 pounds. It is mounted in a horizontal position on the lock wall; turns on a large center pin, and is supported at the rim in four places by rollers. The center pin is keyed into a heavy casting anchored securely to the concrete.



CROSS SECTION THROUGH CENTER WALL OF LOCK.

The crank gear or "bull wheel" has gear teeth on its rim and is driven by a single pinion on a vertical shaft. The vertical shaft is driven by a bevel gear and pinion, the pinion being fast on a horizontal shaft passing through the bulkhead, which separates the motor chamber from the bull-wheel chamber. This shaft carries a gear with spring center which is driven by a pinion on the back shaft of the motor.

The strut pin is fastened on the wheel in a boss near the rim of the crank gear. The opposite end of the strut or connecting rod is fastened to the gate at a distance of seventeen feet from the pintle by means of the strut anchor. The connecting rod consists of a built-up structural member with flexible connection at either end, and a spring shock absorber at the gate end. The purpose of the shock absorber is to prevent undue strain on the crank gear from wave action on the gate, or other causes. It consists of six nests of two springs each, capable of exerting, when solid, a force of about 184,000 pounds and assembled with an initial compression of about 50,000 pounds. The springs are in compression for a force acting in either direction on the strut. A slip joint allows for lengthening or shortening the strut within fixed limits.

The strut is supported at the slip joint by a pair of rollers, which are intended to relieve the joint of undue

bending strains. These rollers are supported in spring bearings, which allow for variation in the distance from the center line of the strut to the roller track. The roller track is riveted to the top girder of the miter gate.

The crank gear end of the strut turns through an agle of about 197 degrees on the pin circle and back again over the same path. At the extreme position the strut is on a dead center with respect to the crank gear and can exert a force on the miter gate depending only on the strength of the strut, crank gear, or gate.

The miter-forcing machine is designed to force the gate leaves to perfect miter and lock them in mitered position. It consists essentially of two box-shaped castings, one bolted to the outer end of the top girder of each gate leaf, one casting carrying a pair of movable jaws and their operating mechanism and the other carrying a large pin, which is inclosed by the jaws when they are in the closed position.

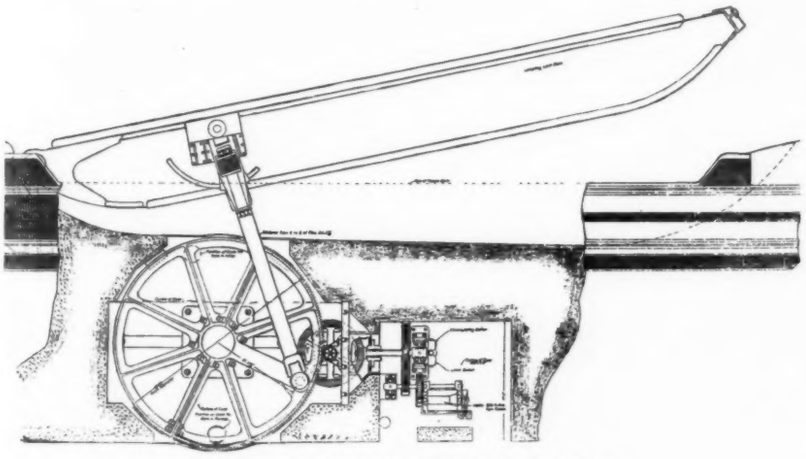


DIAGRAM OF LOCK-OPERATING MECHANISM.

The jaws are connected by a series of toggle links to a crosshead nut which is moved by means of a revolving screw. The end thrust of the screw is taken up by two thrust bearings which transmit thrust in either direction to the main frame casting. The screw is turned by a bevel gear in mesh with a bevel pinion on the motor driving shaft. This driving shaft passes through a plug bearing and is connected to the motor shaft by means of a friction cut-off coupling. The forces acting on the jaws are transmitted directly to the frame through pins when the jaws are in the locking position, and there is no strain on the screw due to forces acting on the jaws. When in open position the jaws allow either gate leaf to reach the mitering position without interference from the other.

The motor is provided with a solenoid brake for bringing the machine quickly to rest when the current is shut off by the limit switch. The estimated time of a single operation for this machine in one direction is fifteen seconds.

One gate-moving machine will be required for each gate leaf, ninety-two in all; one miter-forcing machine for each gate or pair of leaves, forty-six in all; one motor for each gate-moving machine and one for each miter-forcing machine, 138 in all. Two gate-moving machines, one miter-forcing machine, and three motors will be purchased first and given a thorough test, in service, before the contract for the whole quantity is let.

Electrically Operated Dock.

The Government of Canada having agreed to guarantee interest on cost of a large shipping dock to be built at Esquimalt, near Victoria, its construction has been started. The dock will be 900 feet long, 100 feet wide, and will cost $3,000,000. It is announced that reinforced concrete and steel will be used for the dock walls. The machinery to be supplied will be driven by electricity, and even the capstans for warping vessels in and out of the dock will be operated by electricity. There will be thirty-five feet of water on the sill at low water.

Exports of Copper.

For the week ended May 11, exports of copper were 5,427 tons. Since May 1, exports were 10,010 tons, as compared with 12,121 tons for last year.

Electric Plant for Coal Mine.

The Victor-American Fuel Company, which owns one of the most up-to-date and modern coal-mining plants in the Southwest, has been operating steam plants at three of its coal properties near Gallup, New Mexico. A short time ago it decided to install a central turbine plant, and transmit power from this to its other properties. To this end the company constructed a fireproof power house built of brick, with steel-supported roof, in which it is installing one 300-horsepower water-tube boiler, and three 100-horsepower marine boilers with Illinois stokers, space being left for additional boilers to be installed later. Steel coal bunkers are provided which receive coal from a table about 200 feet away. The ashes from each boiler fire pot are emptied into a special car underneath the boilers

In the generator room the present installation will consist of two 500-kilowatt 2,300-volt three-phase General Electric horizontal condensing steam turbines operating at a speed of 3,600 revolutions per minute and a frequency of sixty cycles, space being left for two additional units. The exciters will consist of two continuous-current fifteen-kilowatt 125-volt General Electric condensing turbo-generators operating at a speed of 4,500 revolutions per minute.

The switchboard will have blue Vermont marble panels and standard finish instruments. It will consist of two fifteen-kilowatt direct-current exciter panels, two 500-kilowatt alternating-current generator panels, and four alternating-current single-circuit feeder panels.

There are at present four feeder circuits radiating from the power house. One circuit goes to the Heaton mine, about 1.25 miles distant, where about 300 kilowatts in motors are installed; another runs in the opposite direction to the Company's Navajo mine, where it has approximately 600 kilowatts in motors; the third circuit goes to the Bartlett mine, about 1.5 miles away, where 200 kilowatts in motors are installed; the fourth circuit goes to the town of Gallup, five or six miles away, where the electricity will be used for lighting and power. A voltage of 6,600 was decided upon as a suitable potential for transmission, as some of the developments were situated four to six miles from the plant. All the circuits are protected by aluminum-cell lightning arresters.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO RAILWAYS COMPANY.

The Chicago Railways Company has issued its annual report, covering the twelve months ended January 31, 1911. The income statement (joint account with the city of Chicago) compares as follows:

	1911	1910
Total earnings	$14,064,709	12,442,882
Expenses and taxes	9,845,296	8,710,017
Bal., 30% of gross	4,219,413	3,732,864
5% on value	2,865,531	2,275,718
Net income	1,353,882	1,457,146
City proportion, 55%	744,635	801,430
Co.'s proportion, 45%	609,247	655,715

The non-partnership account of the Chicago Railways Company compares as follows:

	1911	1910
*Gross income	$3,816,107	$3,114,637
Bond interest	3,067,702	2,417,722
Miscellaneous	61,271	.....
Sinking fund	250,000	250,000
Corporation expenses and adjustments	163,884	150,757
Total deductions	3,542,857	2,818,480
Net available for dividends	273,250	296,157

*Consists of 5% interest allowed on investment, Chicago Railways' share of net income (45%), and miscellaneous interest.

The general balance sheet as of January 31, 1911, compares with that of January 31, 1910, as follows:

Assets:	1911	1910
Road equip. and franchise	$79,786,411	$57,024,117
Bonds dep. as collateral	9,265,200	9,265,200
Cash and cash items	8,358,953	7,044,001
Accounts receivable	178,797	439,852
Total	$99,147,526	$75,058,849
Liabilities:		
Preferred stock	$ 100,000	$ 100,000
Current liabilities	3,744,787	2,345,334
Interest and taxes accrued	1,346,766	1,215,874
Reserve for damages	650,323	400,961
P. & L. surplus	213,490	156,645
Total	$99,147,526	$75,058,849

PACIFIC GAS AND ELECTRIC.

The Pacific Gas & Electric Company has issued its report for the year ended December 31, 1910. The income account compares as follows:

	1910.	1909
†Gross revenue	$13,859,964	$13,332,501
Operating expense, taxes, reserves, etc.	7,921,341	7,531,576
Net revenue	5,938,623	5,800,925
Interest	3,006,156	2,988,522
Balance	2,932,467	2,812,403
Preferred dividends	600,000	600,000
Sinking fund	733,402	667,209
Bond discount	47,220	42,237
Total deductions	1,380,622	1,309,446
Surplus	*1,551,844	1,502,957

*Equal to eight per cent on $19,272,500 outstanding common.

†Does not include revenue in suspense (San Francisco rate cases) as follows: 1910, $369,264; in 1909, $317,574; in 1908, $116,882.

UNITED RAILWAYS INVESTMENT COMPANY.

The United Railways Investment Company, which is a holding concern for the United Railroads of San Francisco, the Philadelphia Company, and other street railway and power companies, earned a surplus of $766,468 for the year ended December 31, 1910. This is equivalent to 4.79 per cent. on the $16,000,000 of preferred stock, which compares with 3.2 per cent. earned in 1910 and 1.7 per cent. in 1909.

In his report to the stockholders, President Ernst Thalman says that the acquisition of the Sierra & San Francisco Power Company has resulted in a substantial saving to the United Railroads in the cost of its power. He notes that $20,000,000 of the $41,000,000 common stock of the Philadelphia Company was listed on the Parquet of the Paris Bourse in March, 1911. "The Directors believe," says the report, "that the result of this action, which was accomplished only after prolonged negotiations, will be beneficial not only to the holders of the securities of the Philadelphia Company, but to the stockholders and security holders of the United Railway Investment Company."

At the annual meeting of the Investment company in Jersey City Emil Loeb and Eben Richards were elected directors, succeeding M. Kubierskchy and C. S. Shepard.

SYRACUSE LIGHT & POWER.

The Syracuse Light & Power Company has reported to the New York Stock Exchange for the twelve months ended December 31, 1910, as follows:

Gross earnings	$274,769
General expenses and taxes	1,689
Net earnings	273,080
Bond interest	264,691
Surplus	8,389

PHILADELPHIA ELECTRIC COMPANY.

The annual report of the Philadelphia Electric Company for the year ended December 31, 1910, shows gross earnings of $5,946,026, against $5,489,903, and surplus after dividends, $339,141, against $392,480. The income account shows the following:

	1910.	1909.
Gross	$5,946,026	$5,489,903
Operating expenses and fixed charges	4,729,647	4,287,642
Net income	$1,216,378	$1,202,261
Less dividends	877,237	809,780
Surplus	$ 339,141	$ 392,480
Previous surplus	1,783,499	1,391,018
Deduct stock dividends	1,499,265	.....
Total surplus	$ 623,375	$1,783,499

UNITED RAILWAYS OF BALTIMORE.

The annual report for the year ended December 31, 1910, of the United Railways & Electric Company of Baltimore is issued. The income account compares as follows:

	1910.	1909.
Gross	$7,687,894	$7,209,983
Expenses	3,601,796	3,361,871
Net	4,086,098	3,848,112
Other income	2,490	2,490
Total income	4,088,488	3,850,602
Charges	2,801,635	2,734,187
Surplus	1,286,853	1,116,415
Extra expenses, etc.	924,048	*1,013,413
Balance	362,804	103,001

*Included in this amount is $466,692 advanced to the treasury for improvements in 1906 and since carried as a deferred asset.

SAO PAULO TRAMWAY.

The Sao Paulo Tramway, Light & Power Company has issued its pamphlet report for the year ended December 31, 1910. The income account compares as follows:

	1910.	1909.
Gross earnings	$2,949,293	$2,439,486
Operating expenses	962,337	846,627
Net earnings	1,986,955	1,592,859
Charges	383,862	371,986
Surplus	*1,603,093	1,220,873
Dividends	999,992	978,367
Renewals, etc.	200,000	150,000
Surplus	403,100	92,005

*Equal to 16.03 per cent on $10,000,000 capital stock, before charging out renewals, as compared with 12.21 per cent earned on same stock in previous year.

RIO DE JANEIRO TRAMWAY.

The Rio de Janeiro Tramway, Light & Power Company has issued its report for the year ended December 31, 1910. The income account compares as follows:

	1910.	1909.
Gross revenue	$10,960,180	$7,527,559
Operating expenses	5,567,088	4,459,252
Net revenue	5,393,092	3,068,307
Other income	40,484	370,188
Total income	5,433,576	3,438,495
Interest, general and legal expenses, taxes, etc.	3,096,433	2,288,887
Surplus	2,337,143	1,149,608

A comparative analysis of the gross and net earnings of the company follows:

Gross revenue:	1910.	1909.
Tramways	$6,439,466	$3,641,779
Telephone	256,801	209,681
Light and power	1,836,289	1,130,448
Gas	2,836,289	1,130,448
Gas	2,427,625	2,545,651
Net revenue:		
Tramways	$3,341,230	$1,745,137
Telephone	130,588	109,090
Light and Power	1,374,631	836,510
Gas	546,643	377,569
Total	5,393,092	3,068,307

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company, for the month of March and six months ended March 31, 1911, compares as follows:

	1911.	1910.
March gross	$ 371,992	$ 336,197
Expenses	234,484	220,790
March net	137,508	115,407
Charges and taxes	46,423	40,675
March surplus	91,085	74,731
Six months gross	2,202,915	1,992,236
Expenses	1,370,473	1,216,984
Six months net	832,442	775,252
Charges and taxes	229,205	212,586
Six months surplus	603,237	562,666

PUBLIC SERVICE CORPORATION.

The Public Service Corporation of New Jersey reports to the New York Stock Exchange the following statement of earnings and expenses of Public Service Corporation of New Jersey and subsidiary companies for the three months ending March 31, 1911:

Gross earnings operating companies	$7,117,252
Income from misc. sources	379,703
Total	7,496,955
Operating expenses and taxes	4,019,446
Net	3,477,509
Fixed charges of oper. companies	2,684,665
Balance	792,843
Fixed charges of Pub. Serv. Corp. of New Jersey	538,410
Surplus	254,433
Profit and loss Dec. 31, 1910	1,706,185
Total surplus	1,960,618
Dividend paid March 31, 1911	375,000
Balance	1,585,618
Adjust. (credit)	20,794
Profit and loss March 31, 1911	1,606,413

QUESTIONS and ANSWERS

LOADED TELEPHONE LINES.—What is meant by a loaded telephone line? What are loadng coils?—W. St. C., Cedar Rapids, Iowa.

A long telephone line, particularly if it is a cable circuit, possesses considerable distributed capacity which has a tendency to distort the voice currents and therefore render the transmission of speech more or less inarticulate. It was pointed out many years ago by Oliver Heaviside, an English physicist, that when the resistance, capacity and inductance of a line wire properly balanced there is no distortion of the current. Prof. M. I. Pupin, of New York, showed that this condition can be realized practically by the introduction of inductance coils at definite intervals along the line. These coils are called loading coils or Pupin coils and a telephone line provided with them is called a loaded line. The use of these loading coils counteracts the excess capacity and greatly extends the distance that telephonic communication can be carried on. Thus, within a few weeks long-distance telephone service has been successfully opened between New York City and Denver, a distance of over 2,000 miles, this being made possible by the use of loaded telephone circuits.

DAMPING DISKS ON METERS.—Why is an aluminum disk with magnets on either side of it used on an electric meter.—J. M., Knoxville, Tenn.

An ordinary electric watt-hour meter is a form of electric motor whose driving force or torque is obtained from the interaction of the current (series) and potential (shunt) coils. If the only load or resisting force on such a motor were the friction of the bearings and of the gears in the recording mechanism, it would tend to run at enormous speed with heavy line currents and not at all proportional to them. Therefore some artificial load must be placed on the motor of the meter so that the latter will register at a speed directly proportional to the line current. The so-called damping disk placed between permanent magnets constitutes such a load. The movement of the disk between the magnet poles causes the cutting of lines of force which results in the generation of a small electromotive force between the circumference and the center of the disk and, since this is a closed electric circuit of very low resistance, so-called eddy currents are thereby produced in the disk. The reaction of the magnetic field of the eddy current and the field of the magnet causes a retardation of the motion of the disk and therefore furnishes the mechanical load or damping desired. The disks are usually made of aluminum, so as to place as light a weight on the step bearing of the meter spindle as possible.

PRINTED COPIES OF PATENTS.—In your weekly list of electrical patents I noticed recently mention of a patent that interests me very much. Can I secure a printed copy of this patent in full otherwise than through a patent attorney?—R. T. H., Aurora, Ill.

Printed copies of American patents can be obtained for five cents each on application to the Commissioner of Patents, Washington, D. C. In writing for such copies the number and title of the patent and the name of the inventor must be given.

GENERATION OF ELECTRICITY DIRECT FROM COAL.—What credence can be given to the newspaper accounts that have been printed a short time ago about the invention of a means for generating electricity direct from coal?—P. B., Baltimore, Md.

Many investigators have worked on this problem without any practical and scarcely any theoretical success. Despite the newspaper announcements from time to time that some inventor or other has found a method of doing this, no credence should be given to what is evidently an exploitation scheme until an inventor shows conclusively to the satisfaction of both scientists and engineers that he has really solved the problem.

POSITION OF LAMPS IN WINDOW LIGHTING.—Where is the best place to have the lamps mounted for lighting store windows?—J. M. S., Kansas City, Kans.

The best results in store-window lighting are undoubtedly obtained by placing the lamps in properly designed reflectors along the upper front edge of the window, so that their light is thrown downward and backward upon the goods displayed. The reflectors should not only direct the light evenly upon the exhibits but should also screen the lamps from the view of any one looking in at the window. By placing the lamps at the top as directed this is already accomplished to a considerable degree. There is a common but very erroneous opinion that the lamps must be put near to the object to be illuminated, as the result of which they are very often placed so that their strong direct rays enter the eye and compel the iris to partly close for protection, thus producing the uncomfortable sensation of glare which defeats acute vision.

GAS "ARCS."—In the so-called gas "arcs" is there really anything that justifies the word "arc"?—A. C. F., St. Paul, Minn.

There is nothing about a multiple-mantle gas lamp that corresponds to the arc of an electric arc lamp. When the gas interests found that there was nothing they could offer in a single-burner lamp that could meet the strong demand among merchants for a high-candlepower lamp such as the arc lamp, they devised a clustering of several mantle burners in a single globe and announced it as a gas "arc," thereby bearing out the old saying that "imitation is the sincerest flattery."

DOUBLE-CURRENT GENERATOR.—What is meant by a double-current generator?—H. R. B., Flint, Mich.

If a rotary converter is driven by some prime mover it operates as a generator and can deliver either direct current or alternating current or both. When it delivers both direct and alternating currents from the opposite sides of its armature it is operating as a double-current generator.

New Electrical and Mechanical Apparatus and Appliances.

Features in the Design of Electrolytic Arresters.

Oil in the tanks of electrolytic lightning arresters is in contact with the electrolyte in the trays. It, therefore, soon becomes "wet." That is, it absorbs moisture from the electrolyte. It has been found that organic substances, such as wood or fiber, when used between electrolytic arrester trays, absorbs moisture from the "wet" oil and thereby becomes conducting. They carbonize and difficulties ensue. So that there can be no trouble from this condition, in Westinghouse electrolytic arresters, separators of porcelain are used between the trays. The wooden tie rods, which bind the tray structure together, are not in contact with any trays except the top and bottom ones of each section. The rods are supported out in clear oil.

A porcelain seperator is shown in Fig. 1. Fig. 2, a sectional view of three trays, filled with electrolyte, shows how the separators are used. Four separators are used between each pair of trays. Each stack of trays and separators is clamped with iron nuts turning on the threaded ends of wooden tie rods.

In each Westinghouse electrolytic-arrester tray there are four holes which, when the trays are stacked,

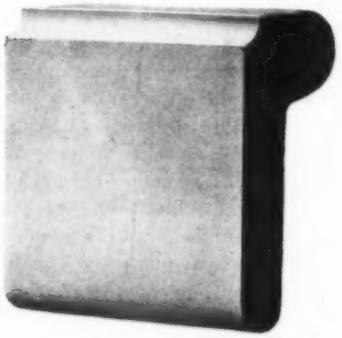


FIG. 1.—SECTION OF PORCELAIN TRAY SEPARATOR.

form a verticle oil duct through which oil can circulate. This promotes the discharge of bubbles from the electrolyte and assists in maintaining an arrester at a low temperature when it is operating continuously for a long period. Another feature that assists in the effective discharge of bubbles is the contour of the tray. It will be noted from Fig. 2 that the outer portion of each tray is of such shape and so inclined that bubbles, forming in the electrolyte, will be discharged directly into the oil. A horizontal lip, formed

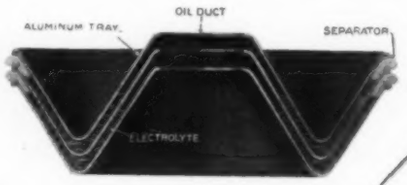


FIG. 2—SECTIONAL VIEW SHOWING METHOD OF SEPARATING TRAYS.

around the tray edge, would constitute a pocket which would obstruct the bubble discharge. Therefore, such construction has been avoided.

Tray structures for these electrolytic arresters are divided into sections or units, each section being small enough so that it can be readily handled by a man, when he is putting it in or withdrawing it from a tank.

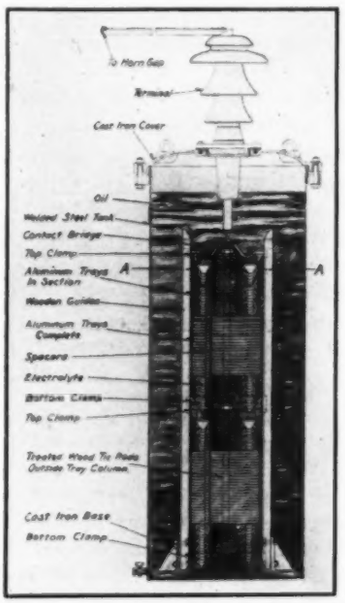


FIG. 3—SECTIONAL VIEW OF ARRESTER COMPLETE.

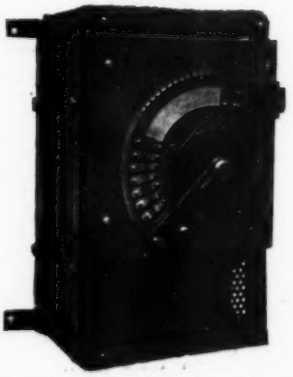
Ample oil space is provided between the tray structure and the inner surface of the sheet-iron tank, as shown in Fig. 3. In computing the clearance necessary between the trays and tank, for sufficient insulation, it was assumed that the oil would always be "wet." Two very desirable things accrue because of the allowance of this liberal clearance. One is that the oil volume, hence the ability of the arrester to discharge continuously, is greatly increased.

The other feature is that it is not necessary to hang a circular screen of some organic insulating material, down in the tank around the tray structure, to prevent arcing between the trays and the bank.

New "Compound" Speed Regulator.

The new compound speed regulator built by the Cutler-Hammer Manufacturing Company combines in one device the simple type of motor speed regulator for decreasing speed, with a motor field regulator. This permits, by means of the operation of a single lever, the starting of the motor, varying the speed up to normal and increasing the speed above normal. Increasing of the speed above normal is accomplished by inserting external resistance in the shunt field of a shunt or compound motor. This regulator provides 100 per cent variation by field control, and fifty per cent by armature resistance. For controlling the speed of motor-driven fans and machine tools it is well adapted. Where large variations are desired and only one voltage available it is a most economical and convenient means of control.

The device shown in the accompanying illustration, is compact, has only one lever, automatic release from any point, and renewable segments. Standard sizes are made from one-fourth to fifty horsepower for 115, 230 and 500-volt circuits in two separate types, fan type and machine type.



CUTLER-HAMMER "COMPOUND" SPEED REGULATOR.

New Telephone Exchange at McPherson, Kansas.

New facilities for handling subscribers' and rural lines have just been put in service in the exchange of the McPherson Telephone Company, at McPherson, Kans. The switchboard and accessories are up-to-date in every particular and make this exchange one of the best equipped for its size in that section of the country.

The McPherson Telephone Company is owned by the business men of that town. Last year the officers of the company started an investigation to find out for themselves what was the best equipment for their telephone system. There had been a demand among some of the subscribers for the central-battery method of operation, and it was finally decided to discard the magneto equipment of the city lines.

The Western Electric Company's proposal was accepted and a central-battery equipment, conforming in every way with the best telephone practice, was purchased and installed in the McPherson exchange. The company now occupies the second and third floors of the Farmers' and Merchants' Bank Building. The installation of the new equipment makes practically a complete new exchange.

The new board consists of five operators' positions. Two operators handle the subscribers' lines, one takes care of a combination subscribers' and rural section; there is one rural section, and the equipment is completed by a special section employed for toll switching and night toll service.

In providing facilities for this exchange ample provision was made for future growth. The McPherson Telephone Company expects to be larger than it is now, and has planned this exchange with a view to taking care of a large number of additional lines. Its ultimate capacity is 1,600 lines, and at present it is equipped for 600. There are twenty out-going trunks, with a capacity of twice that number.

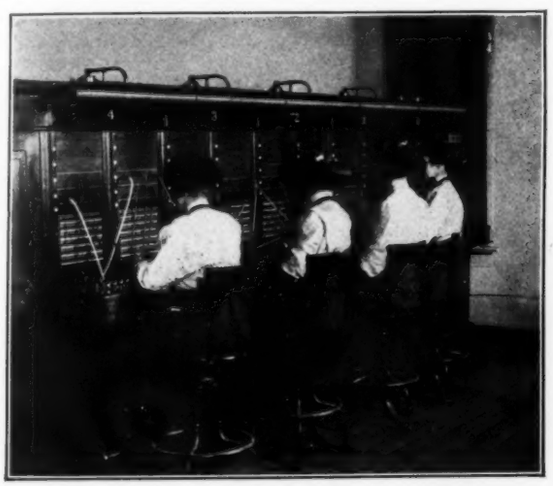
The equipment further consists of 140 combined jacks and signals for the rural and magneto party lines. There are ten combined jacks and signals for night service on the toll switchboard. Five outgoing call-wire circuits have been installed, with a capacity in the exchange for eight.

There are two cable-turning sections. Cable, racks, distributing frames, supervisory equipment, harmonic converters and a power plant consisting of a storage-battery equipment and mercury-arc rectifier, have been provided.

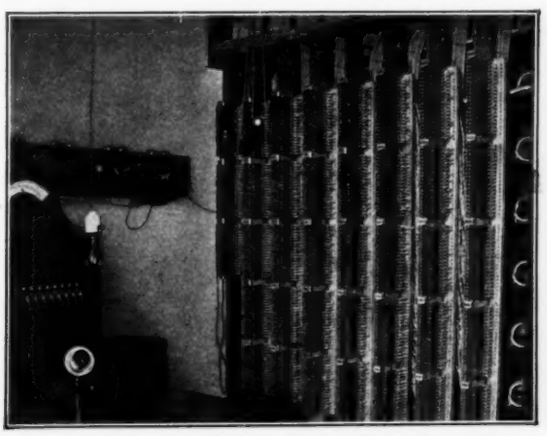
The main distributing frame contains on its horizontal side the full equipment of eight shelves. The ultimate capacity is 320 lines per shelf, and the present equipment is 160. There are eight verticals for the protectors, half as many as are provided by the ultimate capacity of the frame. The total number of protector lines is 800.

The wire chief's desk is arranged for one operator. It is wired for a testing circuit, two test lines to the main frame and two to the switchboard; two incoming trunks (ultimate capacity five), and telephone, ringing, call-wire and buzzer circuits.

Provision has been made for one chief operator. The chief operator's desk contains five incoming trunks, four monitoring key circuits, four line-monitoring lamps and four cord supervisory-monitoring lamp circuits.



SUBSCRIBERS' AND RURAL SECTIONS.



WIRE CHIEF'S DESK AND PROTECTOR EQUIPMENT.

Large Generator for Washington Company.

The Washington Water Power Company has just placed an order with the General Electric Company for two of the largest water-wheel-driven generators ever constructed. These machines, which are to be installed at the Long Lake plant of the Washington company, will be three-phase generators of the horizontal type and will have a capacity of 13,900 kilovolt-amperes and will be of so liberal design as to be able to carry a twenty-five-per-cent overload continuously. They will operate at a speed of 200 revolutions per minute and will generate current at a potential of 4,000 volts.

Canadian Holophane Company Organized.

The Holophane Company, Limited, of Canada has been organized and will be ready to do business June 1. The Canadian Company will be under direct charge of C. A. Howe, as general manager, who has been in charge heretofore of the Chicago office of the Holophane Company. He will be assisted by H. D. Howe, who will hold the position of secretary in the Canadian company.

Holophane, Limited, will have its offices and stock rooms at 60 and 62 Front Street, West, Toronto, where a large and complete stock will be kept for immediate shipment.

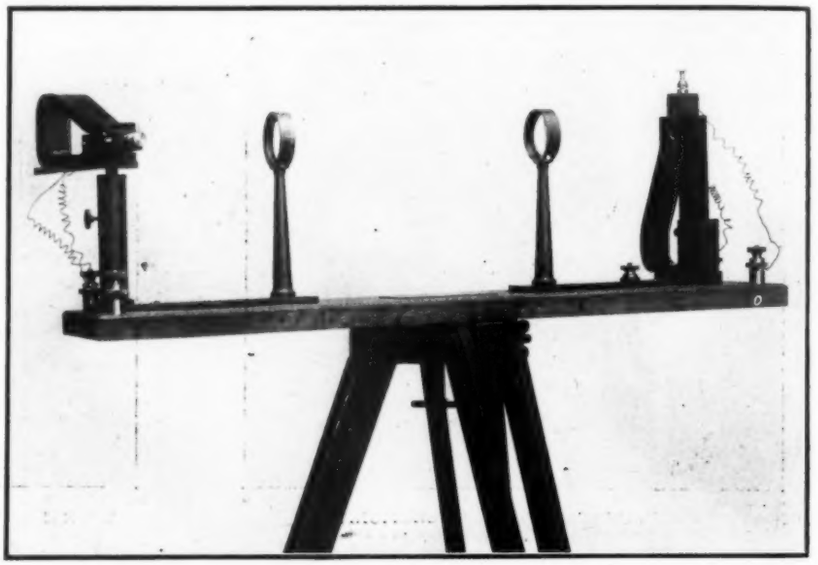
Hysteresigraph.

Hysteresis curves of any given sample of iron can be very readily shown upon a screen by means of a new instrument which is known as the hysteresigraph. It has been recently brought out in Paris by J. Carpenter. The apparatus is based upon the same principle as is used in the Abraham rheograph. The rheograph consists of a galvanometer containing a closed magnetic circuit having in connection with it a fixed winding and a movable winding, this latter being, in fact, a single turn of aluminum bar upon which is mounted a mirror. The movable part swings upon stretched wires so that it causes the movement of a spot of light. Such movement takes place horizontally and the spot is then spread out vertically by an optical device consisting of a revolving prism and a set of mirrors. Combining thus the two movements we have a spot of light which gives the wave form of the current upon the screen.

One of these galvanometers will be observed mounted in a vertical position at the right of the illustration. It traces the wave form of the electromotive force upon the screen and there is a second galvanometer of the same kind which is connected so as to give the wave form of the current. It is possible to combine the two in order to produce the hysteresis curve of the iron. A hysteresis curve represents the respective values of induction and magnetizing force, and since the induction corresponds to the electromotive force and the magnetizing force I to the current, one galvanometer indicates the electro motive force and the second instrument the current in the following way:

The magnetic circuit, which is quite independent of the instrument and contains the sample of iron in question, may be made in the well known form of an iron ring having a continuous winding such as is used in the ballistic method, but in order to be able to test different samples of iron quickly it is preferable to use the iron in the shape of a bar. In this case the iron can have the form of a solid or laminated bar from 20 to 25 centimeters in length. The bar is introduced in a primary coil which covers its length, and there is a secondary winding upon the middle part consisting of a few turns. At each side of the sample the magnetic circuit is completed by a massive iron core whose magnetic reluctance is negligible.

Passing an alternating current in such a circuit in the primary coil the secondary coil will have an induced electromotive force. We then place in series with the primary coil a small transformer which gives current to the rheograph and the deflection of the mirror at each instant represents the instantaneous value of the magnetizing current. On the other hand, we connect the above-mentioned secondary coil upon a second rheograph through a resistance of about 100 ohms, so that the deflections of this rheograph represent the electromotive force or the value of the induction. However, it is necessary to combine these two deflections to obtain the hysteresis curve, and this is done by mounting the two galvanometers as shown in the photograph. One of the galvanometers, for instance the one which shows the induction, is placed so that the rotation of its mirror takes place about a horizontal axis and the second galvanometer (seen on the right) is placed as usual with the axis vertical. The mirror of the first or horizontal (left hand) galvanometer is lighted by a beam coming from an arc lamp and the beam is reflected from this mirror. After reflection the beam passes through a lens whose focus is adjusted so as to be in coincidence with the mirror of the galvanometer. We thus obtain a convergent beam, and this beam moves up and down when the mirror swings vertically. This beam is received at a short distance by a second lens parallel to the first one which is adjusted so as to keep the beam nearly at a constant focus regardless of the swing of the mirror. At this focus is placed the mirror of the second (right-hand) galvanometer with vertical axis and it gives a horizontal swing to the beam. The beam is then reflected to the distant screen and has the two combined movements so that it gives the hysteresis curve which is desired. Not only can the hysteresis curve corresponding to a given maximum induction be obtained but the induction (or current) value can be varied quite easily by using a continuous rheostat so as to vary the values of the maximum current. The tips of the cycles describe the permeability curve of the sample. Any of these curves can be photographed or traced by hand, so that all the magnetic data for a given sample are obtained in a very short time.



HYSTERESIGRAPH.

C. B. & Q. Extends its Telephone Train Dispatching.

The Chicago, Burlington & Quincy Railroad, which was one of the first to use telephones for train dispatching, has just placed an order with the Western Electric Company for twenty-seven of its new selectors and associated telephone equipment for use on its Saint Joseph division.

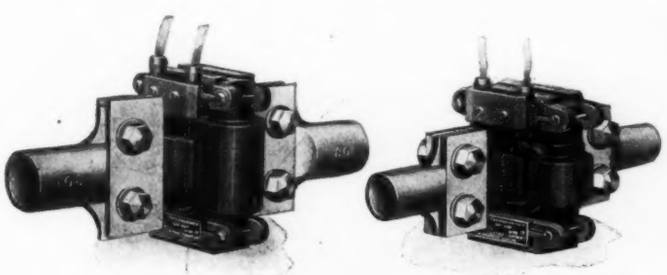
This new circuit will be installed between Kansas City and Napier, Mo.,

a distance of ninety-six miles, and the dispatcher will be located at Saint Joseph. For use with the telephones on this division a suply of the new Western Electric moisture-proof cords have been ordered. Samples of these cords have been under test for some time on other divisions and the results have been so satisfactory that all the telephones on this new division will be similarly equipped.

When this equippment is installed the C. B. & Q. will be operated over 2,700 miles of track by the telephone.

Sangamo Series Transformers.

As the usefulness of the series transformer is more generally appreciated its application is steadily increasing, especially for service in conjunction with measuring instruments, as it permits a range of measurement that cannot be secured with self-contained instruments. Aside from the flexibility of measurement, the series transformer also secures a factor of insulation impossible with self-contained instruments and this fact alone is of sufficient importance to warrant its more general application.



SANGAMO SERIES TRANSFORMERS WITH COVERS REMOVED.

The requirements of modern metering necessitates the use of series transformers having an accurate ratio of transformation, as otherwise it would be useless to employ a meter having high accuracy and then impair the reading or registration by using a series transformer of such characteristics that it had a poor ratio curve. To meet the imposed conditions the Sangamo Electric Company, Springfield, Ill., has developed the type of series transformers illustrated herewith. The design is such that the transformer can be conveniently mounted on the switchboard or other support without entailing expensive busbar construction and the appearance conforms to other high-grade switchboard appliances.

The coils closely fit the iron core, which is securely held in position by locking clamps thus securing a construction which is substantial and permanent and in the larger sizes the busbar itself forms the primary, the secondary winding in all capacities being wound for five amperes. Heavy clamping contacts are provided of sufficient area to carry full load continuously without heating and heavy intermittant loads without damage. The five-ampere leads are brought through porcelain bushings rigidly held in position by suitable supports and particular care has been taken in proportioning the various elements so that a permanently high-insulation value will be maintained under both normal and abnormal conditions.

The electrical design is such that the ratio is very accurate on a wide range, thus insuring accurate measurements at both light and heavy loads.

Motor-Driven Drop-Hammer.

An electrically-driven drop-hammer, as an alternative to the steam-driven type, has recently been brought out by Messrs. Brett's Patent Lifter Company, Limited, of Coventry, England. A good many difficulties have had to be overcome in designing the hammer, principally on account of the difference due to driving by an elastic fluid, and by mechanical means. In the steam type the lifting wing which turns in the cylinder is cushioned perfectly by the elasticity of the steam, and the shock of the falling hammer does not therefore tend to cause damage to the parts. But in a mechanical drive there is no such natural elasticity, and the effect has to be obtained by other means. It is interesting to note that in this 2,500-pound hammer the maximum horsepower used in a test was sixty brake-horsepower, and it was observed that the ammeter needle jumped up to this peak at the moment when the hammer was arrested. Unless the lifter is of an elastic nature, this sudden shock is bound to cause harm.

The mechanism of the lifter is carried upon girders resting on uprights, and the cast-iron guides for the hammer are supported in the cross-girder. The ropes pass up to the lifter, and are caused to life the hammer in the following manner.

The motor drives through a reduction gear and a compensating clutch to the main shaft, which extends above the guides. Two V-shaped lifting-drums are keyed to this shaft, and so revolve constantly with it. A loose pulley is fitted between the drums, its only purpose being to take the weight of the hammer when the rope lifts. To the cross-bar the ropes are attached, and the bar has four V-shaped blocks or brakes of gun-metal, adapted to engage with the V-grooves in the lifting drum. If these blocks are engaged tightly with the drums, the latter will pull up a bar and with it the ropes and hammer; and if the blocks are released, they will fall and let the hammer drop.

The friction blocks are fitted with grease lubricators, so as to ensure that they constantly run on oiled surfaces. The grease does not affect the lifting capacity, but it ensures that the surfaces are kept in a cool state. It also allows of a small amount of slip at the right time, and acts in a way as an elastic buffer.

Messrs. Brett have adhered to the usual type of lever control, so that any stampers can begin to work the new kind of hammer without instruction or difficulty. It is found that the combination of the oiled brake-blocks and the compensating-clutch drive gives sufficient slip to absorb any sudden severe shocks, so that jerkiness is absent, and the life of the ropes is greatly prolonged. The number of brake-blocks is varied according to the size of the hammer. After a run of several hours the brakes become only slightly warmed up, so that there is no necessity for a water-cooling apparatus, which, after all, if used, would only prove that there was a great loss of power by friction.

The National Stamping & Electric Works, Chicago, manufacturers of metal specialties, motors, etc., having outgrown its former quarters, has moved to 426 South Clinton Street, where it occupies the entire second floor.

New Type Commutating-Pole Motor.

The severe service that electric motors are called upon to perform in many industrial power applications, and the consequent necessity for reliability and efficient all-day operation, requires the use of machines possessing exceptionally good commutation, overload and heating characteristics, combined with great mechanical ruggedness. The type CVC commutating-pole motor just brought out by the General Electric Company has been specifically designed to meet such requirements.

The "reason for being" of commutating-pole design may be readily understood if it be remembered that sparking under the brush of a non-commutating pole direct-current machine is almost wholly due to the abscence of a megnetic field, automatic in action and of sufficient intensity to reverse the armature coils successively short-circuited as corresponding segments pass under the brushes.

The commutating poles of CVC motors are connected in series one with another, and also with the armature; their magnetizing power is, therefore, in proportion to the armature current, and may be employed to compensate for armature reaction allowing sparkless commutation over wide ranges of load and under adverse conditions of operation.

In addition to the above, commutating-pole motors allow a wider range of speed control by field than is permitted with motors of non-commutating pole design.

Due to reduced deposition of carbon and copper dust by wear, commutator and brush parts of CVC motors permit great cleanliness.

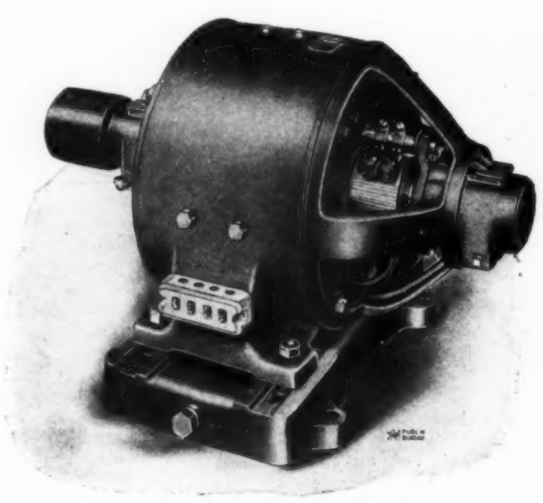
Internal ventilation is secured by a very simple, rigid and durable form of fan mounted on the armature shaft within the pulley end-bearing head. This fan, while consuming a negligible amount of energy, insures cool operation under very severe conditions of temperature and load. Internal ventilation has been advantageously applied to transformers, motor generator sets, etc., for a number of years. A similar application in motor practice is entirely logical, natural and in step with the most advanced engineering practice.

The main field coils are wound on strong horn-fiber spools, amply insulated with pressboard, mica, varnished cambric, etc., to insure freedom from breakdown under possible excess potential strains. The windings are rendered moistureproof by thorough impregnation with a special insulating compound. Before final assembly the coils are armor-wound with a single layer of enamel-covered wire, serving the double purpose of protecting the active windings from mechanical injury and assisting to a higher degree of heat radiation.

The commutating poles are wound with rectangular copper wire, the coils being assembled on horn-fiber spools.

Special pains have been taken to so design the commutator that complete immunity will exist from loose or "high" bars. The commutator bars are insulated from one another and from the commutator shell by selected sheet mica, micrometer gauged to a uniform thickness and of proper hardness to wear down evenly with the copper. The outer corners of the segments are rounded to prevent chipping of the mica and the inner edges are notched out to prevent short-circuiting between the bars. There are small grooves in both the flat sides of the copper segments which serve, when the commutator is hydraulically pressed in its assembly ring, to firmly anchor the mica-insulating segments.

The bearing heads being interchangeable, the relation of the terminal block to the commutator and pulley end heads may be shifted by removing the heads, turning the armature end for end, and finally replacing the heads to correspond with the reversed armature position.



COMMUTATING-POLE MOTOR.

Ornamental Street Posts.

The ornamental lamp posts of the Minneapolis Steel & Machinery Company, one of which is shown herewith, are made entirely of cast iron and weigh approximately 900 pounds. The details of the side brackets are so arranged that the side lights can be either set upright or inverted. Connections between the shaft and base are entirely on the inside and are milled and connections made in the shop before shipment. This makes a complete water-tight base and gives the base a very uniform and artistic appearance.

The distance between the posts when placed on the street is usually about 100 feet, making about eight posts to the ordinary block, four on each side of the street. The sixty-watt and 100-watt tungsten lamps are the sizes recommended, the 100-watt being used for the center light, which usually burns all night, and the sixty-watt for the sides, which are usually turned off about 10 or 12 o'clock in the evening.

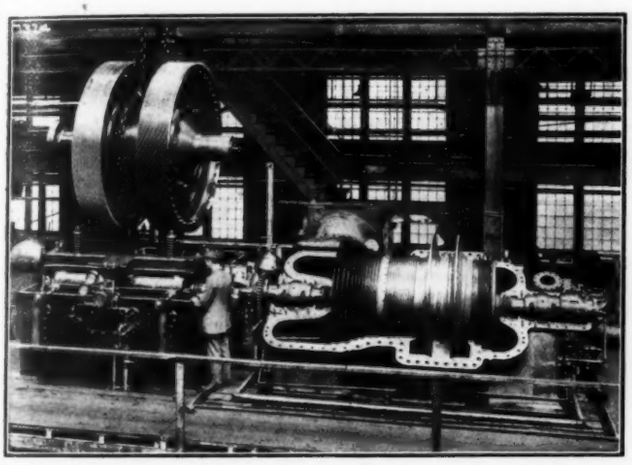
ORNAMENTAL STANDARD.

In some instances, the commercial club of a town appropriates a certain amount for the installation, this money usually coming from business men whose property is most benefited, each contributing an equal amount per foot of space lighted.

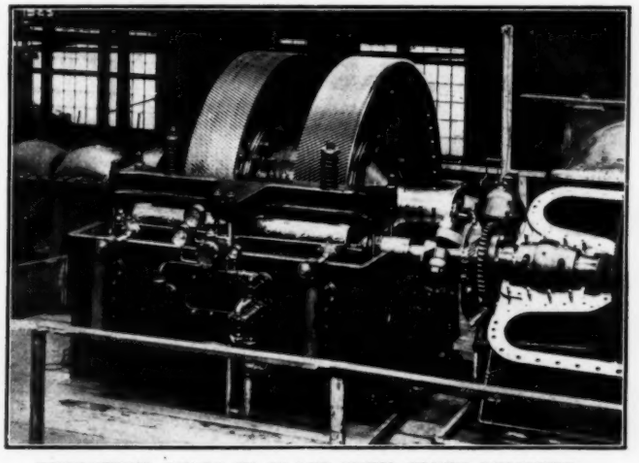
The city council sometimes contributes part of the expense of any funds that are available for betterment purposes, and in some instances the town assumes the entire expense. Some towns take up a separate subscription from all citizens wishing to give. If the installation is made, the town usually assumes the cost of maintenance.

Reduction Gears for United States Vessel.

Two marine turbines and reduction gears have been finished and one has been shipped by the Westinghouse Machine Company and is now being installed upon United States collier *Neptune*, a ship of about 19,000 tons. The second outfit will be shipped immediately and put in place in order to permit of official trials of the *Neptune* in June. These tests are regarded by naval men as of the highest importance because of the use of comparatively small turbines and reduction gears interposed between their shafts and the propeller shafts, it being claimed that the weight of this class of machinery will be less than half of the weight of other turbines having the propellers coupled direct to the turbine shafts or of reciprocating engines, and that, by reason of the higher speed, the turbines used with reduction gears will require, especially for cruising speeds, from 20 to 30 per cent less steam than is now needed by any of the turbine-driven ships or ships driven by reciprocating engines.



MARINE TURBINE AND REDUCTION GEARS WITH LATTER REMOVED FROM CASING.



REDUCTION GEARS IN PLACE WITH COVER REMOVED.

The design of the turbine adopted has an ahead portion and a reverse portion, and a cruising element, all within one casing. The control mechanism is of an exceedingly simple character and is so arranged that each engine may be run in either direction at any speed up to the maximum, either by mechanism operated in the engine-room or by a duplicate operated from the bridge of the ship, the latter feature being of high importance in the manoeuvering of a ship. In fact, the man on the bridge can reverse either or both turbines from full speed ahead to full speed astern in less than fifteen seconds, or in much less time than it now takes to communicate signals from the bridge to the engine-room with other types of control. The speed and direction of both turbines being under instant control, permits of the turning of the ship in the shortest possible distance, and in the event of the steering apparatus being disabled, the ship can be steered and kept to its course by the manipulation of the speed of the turbines. The overspeeding of the turbine engines from any cause whatever, and especially in a heavy sea, is automatically prevented by the governor control. All steam and exhaust connections are made to the lower half of the turbine and the general construction is such that the steam may be turned directly into the apparatus when cold and full speed attained in less than a minute; whereas, the form and dimensions of the turbines which have heretofore been used for naval service have been such that the turbines required pre-heating before starting, such pre-heating taking from three to ten hours, according to the size of the machinery. The upper half of the turbine is arranged so that it can be quickly thrown back upon its hinges in order that all of the blading of the turbine may be quickly inspected

The reduction gearing has a floating frame for maintaining uniform tooth pressure, but the means for floating the pinion frame is of a novel character and not only provides for an elastic motion and a separation of metallic connection between the casing of the pinion and the main casing (which reduces vibration), but at the same time provides a hydraulic dynamometer whereby the exact propeller-shaft horsepower being delivered by a turbine, can be read from a gauge. This dynamometer arrangement is mathematically and practically correct and will give advantages in the running of steamships of the very highest importance.

A demonstration by a trial on the *Neptune* of the practicability of reduction gearing for large horsepowers will, it is believed, change the entire situation with reference to the application of power to naval vessels. The saving of over one-half of the weight in engines and a decrease in the capacity of boilers required because of a less consumption of steam is of the highest importance as it permits of the use of thicker armor and heavier guns.

The turbine and gear equipment being installed upon the *Neptune* represents over five years of study and experimentation under the direction of Mr. Westinghouse in the works of the Westinghouse Machine Company in the development of turbine machinery for the propulsion of ships. The departures from previous practice, which are radical, have been made in the interest of lessening the cost of construction, facilitating the operation of the machinery and its inspection, and in the reduction of the weight and space occupied, as well as in providing a control mechanism whereby the officer in charge of the ship may, without the intervention of any other person, have as complete a control of the engines as he now has of the steering apparatus.

Rubberized Silk.

Silk of various qualities, weights and colors forms the base of the manufacture of rubberized silk, and in some instances it constitutes the largest item of cost. Another trade name for this product is waterproofed silk. Rubber is the waterproofing material, and it is the binding of these two that creates the trade of rubberized silk makers.

The rubberizing tables, or coating tables, are of metal, rectangular in shape and steam heated, the heat being just sufficient to prevent the rapid hardening of the rubber, and yet assist the evaporation of naphtha from the solution.

A roll of silk is then placed in a rack about 2.5 feet from the floor, at one end of the table, and as the silk passes up through the rollers it receives a coat of rubber, which has previously been dissolved in naphtha in iron mills. The coated cloth then passes over steam coils, being held from them by wires, and is rerolled at the other end of the table. The coated cloth is then taken to the dusting room, where it is dusted with a starch made from the potato, prevent sticking.

This process is a rapid one, and many hundred yards of goods can be rubberized in a day.

Solder for Aluminum.

A new solder for aluminum has recently been placed on the market by the Vacuum Engineering Company, Limited, 24 South Molton Street, London, England, which appears to answer admirably for making joints between different pieces of aluminum, aluminum and iron, and aluminum and brass or copper. A special flux is used which is in the form of a white powder, and which has the interesting property of producing, in light articles, a secure joint without the aid of additional solder, the flux itself containing the ingredients necessary to make the two pieces of aluminum unite. In the case of heavier pieces, however, it is necessary to use solder in addition to the flux. The flux melts at a comparatively low temperature, and appears to clean the surface of the aluminum, and to form a sufficient quantity of metal upon it to take the place of tinning. The joints can be made by means of a Bunsen or blow-pipe flame as well as by an ordinary copper-soldering bit. The solder melts at a temperature slightly above that of the flux. It appears to be well suited for making joints in stranded cables, as these can be sweated up solid by pouring the solder through the joint, as in the case of a copper joint. In appearance the solder looks very much like ordinary solder, and makes a very strong joint.

Switch Plates by Electrochemical Process.

The Economy Switchbox & Manufacturing Company, Cleveland, O., is placing on the market a face plate for push-button switches which is chemically treated and cannot tarnish in ordinary use. The plates are lacquered by chemicals during the process employed in bringing about the satin finish. The color of these plates is meeting with the approval of contractors and supply men.

The plates are three-sixteenths of an inch longer than any on the market, which allows the openings made for switches in old work to be completely covered in case the plaster breaks.

The accompanying illustration shows

ECONOMY SWITCH PLATE.

a switch which stood a test of three thousand times, making and breaking contacts. According to this demonstration the life of this switch is estimated at fifteen to eighteen years.

The agents for the switch in Chicago are Kurtz & Company, 622 Monadnock Building.

New Electric Heating Device.

In a new type of electric heating apparatus which is being placed on the market by W. K. Freudenberger, the wire heating element is replaced by a solid piece of plate brass in which large secondary currents are set up by transformer action from a primary winding and core. The brass plate stamped in the form required, annular or rectangular, is, it is claimed, quite indestructible under conditions of ordinary use. In applying the transformer principle the body of the appliance is made of iron or steel and constitutes the magnetic circuit of the transformer. The primary coil is placed in a protected position, separated from the secondary ring, which is the heating element, and may be wound with enamelled or asbestos-covered copper wire, designed for the ordinary service voltage.

The iron or steel body may be a solid casting, stamping or punching, because the usual hysteresis and eddy-current losses are not losses in this case, but are entirely converted into useful heat. In the case of a melting pot for solder, the heating element is very thin, has a large surface in immediate contact with the bottom of the metal pot and requires no insulation, so that the heat is rapidly communicated to the part to be heated. A high efficiency is thus obtained because there is less chance for lateral radiation. On account of the extremely low potential developed in the secondary or heating element it is not short circuited by being placed in contact with the metal pot.

Ample thermal insulation is placed beneath the heating element, and around the pot, to retain the heat and thus increases the efficiency of the apparatus. In large sizes flanges are cast at the junction of the pot and base and these parts are bolted together through the flanges instead of by using long tap bolts through the base. The same principle is utilized for laundry irons, stoves, immersion heaters, curling-iron heaters, coffee percolators and other apparatus. On account of the heat elements being practically indestructible very high temperatures may be used when desirable and quick work may be done.

Electric Cranes.

In the Navy Yard at the Cape of Good Hope there are two electrically-driven swan-necked cranes of fifty and twenty tons working capacity. Each of these cranes lifts its maximum load at a radius of sixty-five feet and can revolve with it through complete circles.

Separate light lift-gear is provided, and, in the case of the fifty-ton crane, each purchase is suspended from a jib-head racking-trolley, which has a horizontal in-and-out motion of ten feet. In the case of the twenty-ton crane the heavy purchase only is operated through the racking-trolley. The maximum height of lift from ground level is, in each case, sixty-five feet, and either hook can descend to a depth of fully forty-five feet below the ground level.

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The New York Edison Company and the United Electric Light & Power Company have formally notified the Public Service Commission that, beginning July 1, they will put into effect a new schedule of rates for electric current, which will mean a saving to their customers of $1,250,000 per annum, based upon the present consumption of electricity. In making these new rates, the companies have yielded to the arguments of the Public Service Commission, which, for more than two years, has been urging upon them the advisability of a simplification of contract forms and a reduction in the prices charged for current. The Commission's investigation into electric lighting matters was conducted by Milo R. Maltbie, through whose efforts the promised reductions have been obtained.

According to the new rates every one using over $25 worth of current a month will receive a discount ordinarily ranging from five to twenty-five per cent. Upon the basis of the consumption during the year 1910, this will mean a saving to the consumers of both companies of $1,250,000, according to the estimates of the companies. The Commission has urged for some time the simplification of the contracts and schedules of rates Many complaints have been made to the Commission regarding the complexity of the contracts and the difficulty of determining what form of contract would be most advantageous to the consumer. Under the new schedules these objections have in large part been removed, and the consumer will find it comparativly easy to determine which form of contract he desires and what he will be obliged to pay under it. Whether these reductions, changes in the contracts and simplification of the schedules will be found entirely satisfactory only experience can demonstrate. These changes have been made without formal hearings or litigation, and the companies have met the Commission in a fair and generous spirit.

Heretofore there have been two general methods of charging for electric current, one by which discounts or reductions were given dependent upon the use of the customer's maximum demand or the average use of his insulation; the other by means of a rate with discounts or reductions based upon the quantity of current consumed. While the companies regard the first method as more correct theoretically, the second is more popular because more readily understood by the general consumer and is devoid of complications or inequalities. The new rates, therefore, will be based upon the second method, namely, the quantity of electric current consumed Under the law, the maximum rate which may be charged for current is ten cents per kilowatt-hour, and under the new rates all current sold by the companies under retail schedule will be at the maximum rate of ten cents per kilowatt-hour with progressive reductions beginning with consumers having bills of $25 a month or more, and depending only upon the total amount of current consumed without reference to the number or type of lamps used, or without any limitation on the installation. The price for electric power service has been reduced to all consumers operating electric motors from a previous maximum of ten cents per kilowatt-hour to 9.5 cents, with reductions based on the quantity of current consumed per month and permitting the combination with the current used for lighting to take advantage of the lowered rate for quantity consumed where of advantage to the consumer. A reduction has also been made in the price of current used for charging storage batteries for pleasure and industrial vehicles under the new automobile storage battery and refrigeration rate, the maximum price for which has been reduced from six cents to five cents per kilowatt-hour, on a minimum monthly bill of $25, instead of $50 as heretofore, with reductions for quantity consumed down to a minimum price of three cents per kilowatt-hour. Modifications have also been made in the special wholesale rates and incidentally in the amount of current obtainable without extra charge under the rates for breakdown service.

The United Electric Light & Power Company, which serves the upper west side of Manhattan, will put into effect a similar schedule on July 1. Its officers announce that the new rates will effect a saving to all consumers whose bill is in excess of $25 per month, and that the aggregate saving to such consumers will exceed $75.000 per annum.

This is the third important concession obtained by the Public Service Commission from the electric lighting companies since the organization of the Commission in July, 1907. The first was a resumption by the companies of the furnishing of breakdown service, and the second, the simplification and standardization of forms of contracts which carried with it certain changes in the regulations regarding the use of service and the relationship of the consumer to the company, which were of general benefit to the mass of consumers.

The Public Service Commission, Second District, has received petitions from the Albany Southern Railroad Company asking for permission to begin construction and exercise rights under a franchise granted to it by the towns of Kinderhook and Stuyvesant, Columbia County, for the purpose of conducting and distributing electricity for public and private use. At the present time these two towns are without electric service for light and power purposes.

The Court of Appeals has handed down its decision in People *ex rel.* Cohoes Railway Company, appellant, *vs.* Public Service Commission for the Second District and Francis P. Lithgow, an intervenor, respondents, affirming the order of the Appellate Division which confirmed the order of the Commission and required the Cohoes Railway Company to discontinue charging a six cent fare between Rensselaer and Albany in either direction.

The Public Service Commission, Second District, has received a complaint from the Board of Trade of the village of Adams, Jefferson County, directed against the Black River Telephone Company, as to the rates charged for telephone service in that village. It is alleged that the rates now charged are unjust, unreasonable, discriminatory and unfair, and were made in violation of law and of the franchise granted by the village. The company was given a franchise upon the express stipulation that the charges for service in the village and vicinity should not exceed $15 per year for business places and $9 for residences, with a schedule of rates to outlying places. On March 11, 1911, the rates were increased to $30 per year for business places, $24 per year for two-party line, $18 per year for multi-party line; for residences the charge was made $21 for direct line, $18 for two-party line, and $15 for four-party line. The Commission is asked to make an order directing that the company be required to reduce its rates to those provided in the franchise in June, 1901. The complaint has been served upon the company and an answer required within twenty days.

The Commission heard, a short time ago, the complaints of residents of the village of Granville, Washington County, against the Granville Electric & Gas Company, as to the price charged and quality of service rendered the public by the company for electricity and gas in that village; also the application of the Granville Electric & Gas Company for authority to issue bonds.

COMMISSION NEWS FROM INDIANA.

(Special Correspondence.)

The Indiana Railroad Commission has announced that it would issue permission to interurban roads in the state to cross industrial steam road switches with their traction cars without stopping where signal crossing gates carrying red lights during the night are installed. The rule heretofore sanctioned by law required interurban trains to stop and be signaled across by the conductor when approaching an industrial switch. There are so many such switches it occasioned much delay on the part of interurban cars.

W. J. Wood, of Indianapolis, chairman of the Indiana Railroad Commission, is being favorably considered for secretary of the Interstate Commerce Commission, to succeed the late T. A. Moseley, of Massachusetts.

INTERSTATE COMMERCE COMMISSION NEWS.

(Special Correspondence.)

The first telephone case to come before the Interstate Commerce Commission was decided last week. The Chesapeake & Potomac Telephone Company formerly operated an exchange at Drummond, Md., and has been serving old subscribers at the old rates. A new subscriber declined to contract at higher rates and appealed to the Commission. The Commission decided that it was clearly a case of discrimination, but upheld the new rate, and the old subscribers will hereafter have to pay the new rates.

PROPOSALS.

GOVERNMENT WIRING.—The Office of the Supervising Architect, Washington, D. C., will receive sealed bids for the following work:

Work.	Building.	Location.	Date of Closing.
Conduits and wiring..	Post Office.....	Sulphur Springs, Tex.	May 31.
Conduits and wiring..	Post Office.....	Wichita Falls, Tex....	June 6.
Conduits, wiring and Fixtures	Post Office and Court House..	Wilmington, Del. ...	June 7.

Drawings and specifications may be obtained from the custodian of site at the various places where the work is to be carried out or at the office of the Supervising Architect.

POST OFFICE, DUBLIN, GA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 5 for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures of the United States post office at Dublin, Ga., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Dublin, or at the Supervising Architect's office.

LIGHTING AND POWER.

(Special Correspondence.)

MIDDLETON, MICH.—A new electric lighting plant is to be erected by J. A. Garrison.

SPIRIT LAKE, IOWA.—Ornamental street-lighting posts will be installed for four blocks. C.

ST. PETER, MINN.—The Rapidan electrical concern proposes to furnish the city with power. C.

BROWNS VALLEY, MINN.—The installation of an electric light system is being considered. C.

ROSENBERG, TEXAS.—The City Council is arranging for the installation of an electric light and power plant here. D.

WAITSBURG WASH.—The Waitsburg Electric Light Company has been granted an electric lighting franchise in this city. A.

ECHO, WASH.—The Snow Creek Water Company, recently incorporated here, has applied for electric-lighting franchise.

NEWMARKET, IOWA.—A franchise has been granted to the Lee Electric Light Company, of Clarinda, to supply the city with light. C.

MADRAS, ORE.—The municipality has granted to A. E. Hammond an electric lighting franchise covering the streets of this place. A.

LAKEPORT, CAL.—The Mt. Konocti Light & Power Company has been incorporated here by J. A. Foster, J. L. Davis and J. Hastings. A.

SEATTLE, WASH.—The municipality has appropriated $75,000 for the construction and maintenance of a new power house on Lake Union. A.

LEAVENWORTH, WASH.—The Tumwater Light & Water Company has been granted a forty-three-year electric-lighting franchise in this place. A.

BOWBELLS, N. D.—The National Briquetting Company, of Kenmare, has applied to the council for a franchise to install an electric light system. C.

REDDING, CAL.—C. W. Hill has filed notice of the appropriation of 500 inches of water for electric power purposes from Bear Creek in this county. A.

PORTOLA, CAL.—The Portola Lumber Company has established a generating plant here and will furnish this city with electric lights and power. A.

REDWOOD CITY, CAL.—The United Gas & Electric Company has started the construction of a light and power line to Woods, at a cost of about $10,000. A.

JACKSON, CAL.—The Sierra Blue Lakes Power Company will soon begin construction work on its 800-foot dam, a mile and a half below the mouth of Blue Creek. A.

VICTORIA, B. C.—The City Council has decided to spend several thousand dollars in improving the electric lighting system in this city. Bids have been asked for. A.

OROVILLE, CAL.—The Great Western Power Company has begun the preliminary work for the installation of an additional unit at its plant at Las Plumas, Cal. A.

NEWBERG, ORE.—Manager Edwards announces that the Newberg Electric Light Company is to be enlarged to about twice its present capacity within a few months. A.

MOBERLY, MO.—The Randolph County Gas & Electric Company has been incorporated with a capital of $100,000, by Thomas F. Fulkerson, Walter C. Duncan and James T. Menefee.

DULUTH, MINN.—The council will have plans and specifications prepared for the installation of a municipal electric light plant, having appropriated $2,500 for the purpose. C.

CLAREMONT, CAL.—The Pacific Light & Power Company has been granted a fifty-year franchise to light Mills Avenue with electricity from North First Street to the north city limits.

SAND POINT, IDAHO.—The Northern Idaho & Montana Power Company is figuring on the extension of its transmission line from this place to the towns of Hope, East Hope and Clark Fork. A.

LEWISTON, IDAHO.—The Lewiston-Clarkson Improvement Company of this place has been granted a franchise for an overhead or underground electric distribution system in this place. A.

SAN FRANCISCO, CAL.—The National Illuminating Company has been incorporated here with a capital stock of $1,000,000 by S. J. Kenworthy, R. M. Cole, R. M. Barr, G. A. Bartlett and W. E. Bartlett. A.

GREENVILLE, CAL.—President O. C. Pratt, of the Indian Valley Power Company, announces that the electric lighting plant of his company in this city is to be enlarged and re-equipped this summer. A.

SAN JACINTO, CAL.—Plans are being considered for the enlarging of the electric lighting system in this city. New machinery is to be installed inasmuch as the present machinery is not of sufficient capacity. A.

SAN FRANCISCO, CAL.—The Sacramento-Sierra Power & Water Company has been incorporated by C. C. Chapman, C. L. Barsotti, John Muldoon, Dudley Smith and C. J. Lancaster, with a capital stock of $2,500,000.

PAISLEY, ORE.—Business men in this city are arranging to install an electric lighting and power plant this summer. The site selected is the Withers Mill on Summer Lake. A company is to be incorporated some time in May. A.

GOLDENDALE, WASH.—The Pacific States Electric Company, of Portland, Ore., has bought the electric lighting plant of H. W. Fellows in this place for $55,000. It is given out that the system will be extended and improved.

ROSEBURG, ORE.—The electric generating plant of the Roseburg Light & Power Company at this place was destroyed by fire a few days ago, the loss being placed at $50,000 with an insurance of about $12,000. The plant will be rebuilt. A.

SAN FRANCISCO, CAL.—The Northern California Power Company has sold its bonds to the amount of $1,000,000 to N. W. Halsey & Co., of New York and San Francisco. The proceeds of the sale will be used in making betterments. A.

ALAMEDA, CAL.—The Electricity Commissioners of this city have submitted an estimate to the City Council showing that $125,700 is necessary for the proposed improvements to the municipal lighting plant. It is proposed to vote bonds to cover this amount.

BIG BEND, S. D.—Bids may shortly be called for the construction of a power pole line from the 5,000-horsepower plant of the Dakota Power Company to Custer, a distance of twenty-four miles, and thirteen miles further to mining properties in that district. C.

NOBLESVILLE, IND.—Work on the dam of the White River Light and Power Company, two miles from here, has been stopped, owing to lack of funds, and the company has been declared a bankrupt; $100,000 has been spent on the plant. A meeting of creditors will be held here on May 24. S.

SAN ANDREAS, CAL.—The Sacramento Power & Water Company has been incorporated here with a capital stock of $2,500,000 by Charles Chapman, of San Francisco; Charles Barsotti, of San Andreas; John Muldoon, of Berkeley; Dudley Smith, of Oakland, and C. J. Lancaster, of Alameda, Cal. A.

UPPER SANDUSKY, O.—The Hardin-Wyandotte Lighting Company has filed a mortgage here guaranteeing $500,000 issue of bonds to the Citizens' Savings & Trust Company, of Cleveland. The company has absorbed the electric plant at Kenton, Dunkirk, Forest and Upper Sandusky. Current will be supplied from Kenton. H.

ST. LOUIS, MO.—A dam and hydroelectric plant costing $50,000 are to be constructed for the Arcadia Country Club. The dam is to be of concrete. Fifty kilowatts will be generated for a three-phase circuit. Bids for construction are to be submitted before July 15 to the consulting engineers, Dixon-Smith Engineering Company, 820 Wright Building, St. Louis.

MONTICELLO, IOWA.—Fred J. Cross has been voted franchises to install and operate electric lighting and power systems in the cities of Center Point, Walker, Coggon, and Central City, and he has made propositions to several other towns in Linn County for installing a system that will connect a string of towns, to all be supplied from one central plant.

RALEIGH, N. C.—The Carolina Power & Light Company, of this city, has purchased the Standard Gas & Electric Company, which for many years supplied gas for lighting and cooking to Raleigh. The Carolina Power & Light Company now represents about $12,000,000 investment. It is engaged in the completion of an extensive electrical development at Blewett's Falls, in the central portion of the state, and is one of the most progressive concerns in the South. L.

BAKERSFIELD, CAL.—Work is to begin soon on the first of the substations to be built at different points in this section of the country by the San Joaquin Light & Power Corporation. Mr. Stebbins, foreman of construction for this company, announces that Maricopa is to have the first station, Moran the second, then McKittrick and Famosa. Each building will be constructed of steel and concrete and will cover an area of 50 by 30 feet and have a height of thirty feet. A.

MARYSVILLE, CAL.—Paul Downing, electrical construction engineer for the Pacific Gas & Electric Company, states that the present flume and ditch system, carrying water for eight miles around the sides of a mountain to reach the Colgate plant east of this city, is to be abandoned. Instead, a tunnel is to be pushed through the mountain. Another improvement soon to be made by the company is the substitution of steel towers for the present poles on the main transmission lines from Colgate to San Francisco Bay. All the main distributing lines will eventually be carried on these towers. A.

KINGMAN, ARIZ.—The Desert Power & Water Company, which operates an electric power plant and transmission system at this place and in this district, is arranging to issue $400,000 in bonds for the purpose of enlarging its enterprise. It will install additional machinery at its generating plant and extend its transmission line to the chloride district. This company is at present furnishing power for a number of mines in the Kingman district. With the expenditure of an additional $400,000, as is now proposed, this electric power plant and transmission system will be one of the largest in the Southwest, and it is expected that it will have an important bearing upon the further development of the Kingman and outlying mining districts. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

OSCEOLA, IOWA.—It is proposed to construct an interurban railroad to Hopeville. C.

OSKALOOSA, IOWA.—The Iowa Traction Company is surveying for a line to Waterloo. C.

ALEDO, ILL.—The Rock Island Southern is considering the extension of its line to Muscatine, Iowa. C.

DULUTH, MINN.—The street railway company experts to make the Hillside extension of its lines this year. C.

HIBBING, MINN.—The Mesaba Railway Company is planning connecting the towns on the Mesaba range by electric railways. C.

SEATTLE, WASH.—It is expected that the city will shortly commence the construction of an electric railroad in the Rainer valley. C.

OSHKOSH, WIS.—The council passed a resolution to compel the Wisconsin Electric Railway to replace its tracks on Doty Street. C.

LOS ANGELES, CAL.—The Board of Public Works is advertising for bids for supplying the city with two miles of copper trolley wire. A.

SEATTLE, WASH.—It is proposed to construct a street railway line from Oxbow to Lake Burien district. J. H. McLaughlin is interested. C.

SIOUX FALLS, S. D.—The Sioux Falls Traction Company will expend $20,000 extending its line to the plant of the Morrill Packing Company. C.

WENATCHEE, WASH.—L. D. Pratt, on behalf of Tacoma capitalists, has applied to the council for a franchise to build an electric road. C.

MINNEAPOLIS, MINN.—The Minneapolis Northern Suburban Railway Company will commence the construction of its line to Anoka, Minn., about June 1. C.

MILWAUKEE, WIS.—The Milwaukee Electric Railway Company let the contract for the construction of an interurban, seventy-four miles long, to Fox Lake. C.

WAUSAU, WIS.—The Wausau Street Railway Company will expend $50,000 improving its plant, including the extension of the Third Avenue and Sixth Street lines. C.

OWENSBORO, KY.—Plans have been consummated here for the organization of a $2,000,000 company to build interurban lines between Owensboro, Henderson, Calhoun and Madisonville. S.

DULUTH, MINN.—Charles P. Craig and J. G. Williams have organized the Duluth & Northern Traction Company to construct an interurban line 4.5 miles long, from Hardy Street to Tischer Road. C.

REDWOOD CITY, CAL.—The City Council is advertising for bids for a twenty-five-year electric-railway franchise, as applied for by Judge Fitzgerald, to be awarded to the highest bidder on June 26. A.

TYLER, TEXAS.—The city council of Tyler, Texas, has granted a franchise for the construction of an electric street railway here to Thomas O'Hara and R. E. Hoskot, of Dayton, Ohio. Construction work will soon be started. D.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company will shortly apply for a franchise for a cross-town franchise. The company is also planning the extension of its line through Elmhurst, near Sacramento. A.

SANTA CLARA, CAL.—Manager F. E. Chapin, of the Penninsular Railroad Company states that the company will soon apply for a franchise for the construction of an electric railway from this place to the town of Meridian Corners. A.

KOKOMO IND.—Officials of the Kokomo, Marion & Western Traction Company are figuring with various contracting firms for the construction of a traction line between Kokomo, Frankfort and Terre Haute, Frankfort being an intermediate point. S.

MADISON, IND.—It is reported that J. T. Elliott & Sons, Indianapolis, L. M. Ussing, of Ussing, Scovel & Co., Pittsburg, and Messrs. Rhoades & Lamentos, of Philadelphia, have arranged to finance the proposed interurban road to be built from this city to Scottsburg. S.

SIOUX CITY, IOWA.—W. E. Miller, of Bijou Hills, S. D., president of the South Dakota Interurban Railway Company, is authority for the statement that fifty-two miles of road will be built from here to the north line of Garfield township, Clay County, S. D., this summer. C.

SAN FRANCISCO, CAL.—The Sacramento-Folsom Electric Railway Company has been incorporated here with a capital stock of $1,000,000 by F. V. Keesling, H. H. Grau and others. The company plans the construction of a road twenty-two miles long between Sacramento and Folsom and a branch line four miles long. A.

CHATTANOOGA, TENN.—Franchises have been secured to build a street railway system in this city. It is to have interurban extensions, reaching many of the important outlying towns and cities within a radius of forty miles. This new railway system is backed by the syndicate owning all the coal and iron mines surrounding this city.

PETERSBURG, IND.—The plan for the construction of the Vincennes Southern Electric railway has been revived. A number of meetings have been held at prominent points along the proposed line which were well attended and the enterprise looks encouraging. The road is to extend from Vincennes to Jasper and thence to West Baden. Some township subsidies have been voted but not enough to build the road. S.

SAN BENITO, TEXAS.—It is stated by S. A. Robertson, of this place, promoter of the San Benito Interurban Railway Company, that the latter's line will be immediately extended to Santa Maria and that an additional thirty miles of main track will be constructed upon the land of the San Benito Land & Water Company in order to afford facilities for transporting this season's sugar cane and other crops. D.

OAKLAND, CAL.—The Oakland & Antioch Electric Railway Company has signed a contract with J. G. White & Co., of San Francisco and New York for construction work on the company's line between Walnut Creek and Antioch, the road having already been completed between Oakland and Walnut Creek. The company has also reached an agreement with the San Francisco, Oakland and San Jose Railway Company for the use of the latter company's ferry and terminal facilities in reaching San Francisco. A.

DENTON, TEXAS.—Alvin P. Owsley, of Denton, and others are actively promoting the construction of an interurban electric railway between Dallas and this place. The proposition is meeting with much favor by the people of the towns along the route of the proposed line and it is expected that it will be accomplished in the near future. Free right of way is being granted and large subscriptions to the stock of the enterprise by farmers and others have been made in encouragement of the project. D.

BURGOON, O.—Sensational charges are made in the federal court by the Pennsylvania Railwoad, which has asked an injunction against the Fostoria & Fremont Electric line restraining it from crossing its tracks at this place. The plaintiff charges that the village of Burgoon, which granted the electric road a franchise, is a bogus municipal corporation organized for the purpose of giving the franchise and that it be dissolved when that object has been attained. H.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GLENDALE, IOWA.—The Glendale Telephone Company has been incorporated. C.

LYONS, IOWA.—The Tri-City Telephone Company is installing automatic telephones. C.

NEW ENGLAND, N. D.—The North Dakota Independent Telephone Company will put in an exchange. C.

TYLER, TEX.—The Gulf States Telephone Company has been organized with a capital stock of $250,000. P.

LA CROSSE, WIS.—The La Crosse Telephone Company has decided to erect a central building to cost $20,000.

BLUE HILL, NEB.—The Glenwood Telephone Company has been incorporated with a capital stock of $1,980. P.

SILVER CREEK, NEB.—The Silver Creek Telephone Company has been incorporated with a capital stock of $5,000. P.

CROSBY, MINN.—The Aitkin-Deerwood Telephone Company has applied to the council for a telephone franchise. C.

TYLER, TEX.—The Talbert Telephone Company has been incorporated in Tyler, with a capital stock of $25,000. P.

JAMESTOWN, N. D.—The Northwestern Telephone Exchange Company will expend $15,000 on the rebuilding of its system. C.

CEDAR RAPIDS, IOWA.—W. L. DeClow has petitioned the council for a franchise to construct a telephone line to Marion. C.

FOND DU LAC, WIS.—The North American Telegraph Company has commenced the construction of a line to Minneapolis. C.

FERGUS FALLS, MINN.—The Friberg Telephone Company is planning the construction of a line into Elizabeth and Fergus Falls. C.

DES MOINES, IOWA.—In accordance with the new Clarkson law, telephones will have to be installed in coal mines after July 4. C.

ROCKWELL CITY, IOWA.—The store room vacated by the Farmers Clothing store is being remodeled for a telephone exchange. C.

NAPA, CAL.—The Board of Supervisors of this county has granted a telephone franchise covering the highways of the county to John A. Carbone. A.

BEMIDJI, MINN.—Farmers living north of Bemidji have organized the Northern Telephone Line. D. A. Whiting, president, and G. G. Buell, secretary. C.

WAUSAU, WIS.—Contractor Anderes is about to commence the construction of the foundation for the three-story building for the Wausau Telephone Company. C.

MONDOVI, WIS.—The Gilmanton & Dover Farmers' Telephone Company will erect a two-story, cement-block building, 15 by 24 feet, the second story of which will be used for a central station. C.

ELECTRICAL SECURITIES.

At the annual meeting of the General Electric Company, M. F. Westover, secretary, was elected a director, succeeding C. P. Hamilton. Other directors were re-elected.

The Calgary Power Company will issue $350,000 of additional bonds to provide the money necessary for the completion of the plant which the company is erecting at Horse Shoe Falls outside of Calgary, Canada.

DIVIDENDS.

Citizens' Traction Company, Pittsburg; semi-annual dividend of $1.50 per share, payable May 16.

Columbus Railway Company; regular quarterly dividend of one and one-quarter per cent on the common stock, payable June 1 to stock of record May 15.

Cuban Telephone Company; dividend of one per cent, payable July 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	May 15.	May 8.
Allis-Chalmers common	7	7
Allis-Chalmers preferred	26½	27
Amalgamated Copper	62½	63⅝
American Tel. & Cable	82	82
American Tel. & Tel.	148	148⅝
Brooklyn Rapid Transit	78¾	78½
General Electric	156	156½
Interborough-Metropolitan common	18½	18¾
Interborough-Metropolitan preferred	52	54½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	88¾	89
Mackay Companies (Postal Telegraph and Cables) preferred	76¼	75½
Manhattan Elevated	134½	135
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	48	50
U. S. Steel common	75½	74¾
U. S. Steel preferred	118¾	119
Western Union	73¾	74½
Westinghouse common	67½	68
Westinghouse preferred	*110	110

*Last price quoted.

BOSTON.

	May 15.	May 8.
American Tel. & Tel	148⅛	148¾
Edison Elec. Illuminating	286	285
General Electric	156	156½
Massachusetts Electric	18½	18
Massachusetts Electric preferred	88¼	87½
New England Telephone	144½	141½
Western Tel. & Tel. common	19	19½
Western Tel. & Tel. preferred	94	94

PHILADELPHIA.

	May 15.	May 8.
American Railways	44	44
Electric Company of America	12	12
Electric Storage Battery, common	52¾	52¾
Electric Storage Battery, preferred	52¾	52¾
Philadelphia Electric	16½	16½
Philadelphia Rapid Transit	18	17¼
Philadelphia Traction	83	83
Union Traction	46¼	45½

CHICAGO.

	May 15.	May 8.
Chicago Railways, Series 1	80	80
Chicago Railways, Series 2	20½	21½
Chicago Subway	4¾	4¾
Chicago Telephone	122	123
Commonwealth Edison	127	124
Metropolitan Elevated common	22	22
Metropolitan Elevated preferred	66	67

PERSONAL MENTION.

H. H. SINCLAIR has resigned as general manager of the Great Western Power Company of San Francisco.

ROBERT T. LOZIER recently became connected with the firm of Kuntze Brothers, Bankers, of New York City.

A. M. HUNT, of San Francisco, has been appointed consulting engineer for the City of San Francisco for the construction of the Geary Street municipal electric railway.

J. B. ROWRAY, formerly with the Pacific Electric Railway Company, of Los Angeles, has been appointed assistant manager and engineer for the Northern Electric Company, of Sacramento, Cal.

ALBERT SCHEIBLE, of Chicago, the research engineer who is making a specialty of manufacturers' problems, has been chosen president of the Purdue Association of Chicago, an organization to which the electrical graduates of Purdue University belong.

HENRY L. DOHERTY, president of the Cities Service Company, New York, sailed for Europe, Saturday, May 13, on the *Celtic*, to be gone three months. Mr. Doherty will study the gas and electric industry in Paris, Berlin and St. Petersburg.

CYRUS OSBORNE BAKER, the platinum refiner and importer, and Mrs. Baker, sailed for Europe last week, and after witnessing the coronation ceremonies will spend two months at German springs, returning to the United States in September.

H. A. HALLIGAN, vice-president of the Western Electric Company, addressed the Telephone Society of New York on May 16 on the subject of "A Brief Account of the Oldest Electric Company in the United States." The occasion was the 128th meeting of the society.

LEE FISHER, who was associated with the construction, and later the operation, of the Joliet & Southern Traction Company's lines as engineer and traction superintendent, has accepted a position with the Economy Light & Power Company. Mr. Fisher made the change on May 1.

JOHN M. KLEIN, manager of Mathias Klein & Sons, Chicago, Ill., has just returned from a two months' trip to the Pacific coast. Mr. Klein makes this trip annually and combines business with pleasure. He found conditions out West quite promising and sees no reason why the year 1911 should not show a considerable increase in business over last year.

JOHN F. WALLACE, for many years chief engineer of the Illinois Central Railroad and at one time chief engineer of the Panama Canal, has assumed active charge as president of Westinghouse, Church, Kerr & Company. Mr. Wallace, who is also president of the Electric Properties Company, which controls Westinghouse, Church, Kerr & Company, still retains the chairmanship of the Board of Directors of Westinghouse, Church, Kerr & Company, but on account of his well known engineering and railroad experience his greater activity in the affairs of the company was considered advisable. Mr. Wallace, in his new position, succeeds H. H. Westinghouse.

C. E. ROSE, who has been superintendent of the lighting and sales departments of the Little Rock Railway & Electric Company some years past, has resigned to take the vice-presidency and general managership of the Arkansas Cold Storage Company. Mr. Rose will not only be the operating manager of the company but will be financially interested in the same. Mr. Rose has been connected with the Little Rock Railway & Electric Company since his graduation from Cornell in 1905 and his record has been an enviable one. It is with great regret that the officials of the company learned of his intention to sever his connection with the company. Since being in charge of the lighting department of the Little Rock Railway & Electric Company the business of the same has more than doubled, due to the energetic and courteous manner of operating his department. Arthur E. Smith has been appointed superintendent of the sales department and Matthew J. Kenney has been appointed superintendent of the lighting department of the company to fill the vacancies.

LEGAL NOTES.

COMPANY ENTITLED TO DEMAND METER RATES.—An ordinance fixed the maximum rates that might be charged for electricity, providing for both metered and flat rates, and the Supreme Court of North Carolina holds that the contract between the company and the municipality was subject to the principle of interpretation generally applicable "that when a promise is in the alternative, as to do a thing one way or another, the right of election is with the promisor in the absence of an express provision to the contrary." In the case before the court the proprietor of a boarding school for boys, after trying the meter rate and becoming dissatisfied with the charges, demanded a change to the flat rate. But it appeared that after the ordinance had been passed the company had changed from a 12 to a 24-hour service, and that for some time no one had been furnished electricity except by meter rates. Under these circumstances, the company was entitled to demand the meter rate.—Horner vs. Oxford Water & Electric Company, 69 S. E. 607.

ELECTRIC-HEADLIGHT LAW VALID.—The Supreme Court of Georgia holds constitutional a state law requiring all railroad companies to equip and maintain every locomotive used by such company to run on its main line after dark with a good and sufficient headlight which shall consume not less than 300 watts at the arc, with a reflector not less than twenty-three inches in diameter. The court holds that such an act is reasonable, and does not violate the "due process" clauses of the state and federal constitutions because its enforcement will require a loss of property to the company, in doing away with the headlights in use and necessitating an expense for new headlights. Nor does the act violate such clauses by depriving the company of its right to manage its own business. The act does not violate the "commerce clause" of the federal constitution on the ground that it would require at the state line a change of headlights on locomotives doing an interstate business, if other states required headlights of a different kind.—Atlantic Coast Line Railroad Company, vs. State, 69 S. E. 725.

DUTIES OF LIGHT AND POWER COMPANIES IN CASES OF FIRE.—The Supreme Court of California says that no authority can be cited in support of the contention that it is the duty of an electric light and power company to disconnect its wires when a fire alarm is sounded. It would compel the company, upon the one hand, to extinguish all light and power in a district, regardless of the necessity for so doing or be held liable for any consequences that might follow its failure. It takes no account of the fact that by so doing, in the case of a night fire, a district would be left in complete darkness, and that under such circumstances, following the alarm of fire, panic might ensue in hotels, lodging houses, theaters, and residences, and that the resulting damage might far exceed that which the extinguishment of the lights was designed to prevent. No such rule of law exists, and the utmost that will be exacted of lighting companies in this regard is that they shall hold themselves in readiness to cut off the electricity when the necessity arises and they are informed of it by proper authority. Nor is negligence imputable to a company because it does not have

an employee at a fire, charged with the duty of disconnecting particular wires, or signaling for the disconnection of the district. But any reasonable ordinance in this regard which a municipality might adopt would, of course, be upheld, and, if injury resulted from the negligent failure of the light and power company to obey the terms of such ordinance, undoubtedly negligence could be predicated upon it.—Pennebaker vs. San Joaquin Light & Power Company, 112 Pac. 459.

TEXAS TELEPHONE DECISION.—In a decision rendered by the State Supreme Court of Texas, litigation in a telephone case that has been pending for six years was brought to a close. The controversy in this case arose over a contract under which the defendants acquired $35,000 of the bonds of the telephone company. The contract had a clause providing that the total issue of bonds of the telephone company should not exceed $150,000, of which amount $50,000 should be used in extensions and additions to the property of the telephone company. The defendants claimed that this portion of the contract had been breached, in that the company had not negotiated its bonds or spent $50,000 in improving the property, and for that breach of the contract it was entitled to surrender its bonds and recover their value. The telephone company contended that it had never been able to sell its bonds at a reasonable price. After a decision for the defendants in the District Court and a reversal in the Court of Appeals, the Supreme Court held in its decision that the provision of the contract relative to the improvement of the company's property should be treated as a covenant and not as a condition precedent, and that no right to rescind the bonds existed by reason of a breach of said covenant, but merely a right of action for damages. The court further holds that under the findings of the jury the telephone company had not violated said provision of the contract, in that it had never been able to dispose of its bonds at such a figure as would be advantageous to the company, and for that reason the court would not remand the case for another trial, but would render judgment for the telephone company. D.

NEW INCORPORATIONS.

BUTTE, MONT.—The Butte Electric Supply Company has been incorporated with a capital stock of $250,000.

NEW ORLEANS, LA.—The United Public Utilities Company has been formed with a capital stock of $1,257,600. P.

ELMWOOD, WIS.—The Intercounty Light & Power Company has been incorporated with a capital stock of $20,000.

HASKEW, OKLA.—The West Union Mutual Telephone Company has been incorporated with a capital stock of $3,500.

MOBERLY, MO.—The Randolph County Gas & Electric Company has been incorporated with a capital stock of $100,000. P.

GRANDBURY, TEX.—The Grandbury Water, Light, Ice & Power Company has been incorporated with a capital stock of $30,000.

LOUISVILLE, NEB.—The Call County Farmers Mutual Telephone Company has been incorporated with a capital stock of $20,000.

DALLAS, TEXAS.—Promoters of the Dallas-Denton Interurban Railway have decided to incorporate with $500,000 capital stock and start building the Denton line.

NEW YORK, N. Y.—The Fred Lee Company has been incorporated with a capital stock of $25,000 by T. Fred Lee, Fred Green and Philip M. Dreyfuss. The company will manufacture electrical appliances.

BUFFALO, ILL.—The Cerro Gordo Electric Company has been incorporated with capital stock of $12,000 to produce and furnish electricity, gas, water and steam. The incorporators are George B. Conover, J. E. McCann and C. M. Kimball. Z.

UTICA, N. Y.—The Langdon & Hughes Electric Company, with a capital stock of $5,000 has been incorporated to conduct an electrical contracting business. The incorporators are Walter T. Langdon, Dennis A. Hughes and George S. Langdon.

TERRE HAUTE, IND.—Articles of incorporation have been filed with the Secretary of State by the Terre Haute Electrical Porcelain Company. The capital stock is $25,000. The objects of the company is to manufacture electrical porcelain material. S.

RUSSELVILLE. IND.—The Citizens' Co-operative Telephone Company has incorporated to build and equip a telephone system in Russellville and throughout Putnam county. The capital stock is $5,400. D. L. Watkins, R. A. Boyd and William Baine are the incorporators.

RICHMOND, IND.—The Richmond Lamp Manufacturing Company has incorporated, capitalized at $50,000. The object of the company is to establish and equip a plant to manufacture carriage, automobile and other lamps. John M. Judson, John C. Ingram and T. W. Judson are directors. S.

MADISON, WIS.—The Peninsula Power Company, of Madison, has filed articles of incorporation in the office of the Secretary of State. The company proposes to build an electric plant and harness one of the big water powers of the northern peninsula of Michigan. The company is capitalized at $750,000. The incorporators are D. H. Otis and C. A. W. Tresler, of the faculty of the University of Wisconsin, and Henry J. Hunt, associated with members of the faculty.

PORTLAND, IND.—A certificate of the merger as a single corporation, to be known as the Muncie Electric Light Company, of the lighting companies operating in Muncie, Dunkirk, Hartford City, Red Key and Eaton, has been filed for record in Delaware, Jay and Blackford Counties. All the lighting plants in the above-named cities and towns will be supplied with current from the Muncie power house. The new corporation is to have a life of fifty years and is capitalized at $1,000,000. S.

SPRINGFIELD, ILL.—Articles of incorporation have been filed by the East St. Louis Interurban Electric Company, with its principal offices at East St. Louis, Ill. The purpose of the company is to construct a railway from the city of East St. Louis, St. Clair County, Ill., in an easterly direction to a point in the county of Clinton, Illinois. The incorporators and first board of directors are: J. L. Flannigan, W. H. Hauss, Fred W. Kraft, Albert E. Meintz, and Edward L. Cragon, all of East St. Louis. Z.

INDUSTRIAL ITEMS.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has distributed the May number of *Trumbull Cheer*, listing a number of rosettes, receptacles, etc.

F. W. WAKEFIELD BRASS COMPANY, Vermilion, O., has issued a revised price list of fixtures, having found it possible by improved methods to reduce manufacturing costs.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., has issued a booklet entitled "Street Car Operation" for distribution among street-railway men. A number of schemes are suggested for comparing equipment, operators, checking line losses, etc.

THE HANSON & VAN WINKLE COMPANY, Newark, N. J., has issued a circular describing a number of small novelties for facilitating shop work. These include an acid pump, emery tray, wheel trimmer, and other accessories for plating and polishing.

THE SHELBY ELECTRIC COMPANY, Shelby, O., announces that it has opened a branch office at No. 516 Atlantic Avenue, Boston, Mass. The branch is to be in charge of C. H. Smith, who was formerly in the lamp sales department of the Western Electric Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., recently issued Circular No. 1191 covering multiple and multiple-series metallic-flame arc lamps, which are used for lighting places where direct current is available and where high-intensity illuminating units are required.

THE BRILLIANT ELECTRIC COMPANY, Cleveland, O., has issued a bulletin upon the new method of rating in which the announcement is made that the company's engineering department will shortly issue a technical bulletin which will serve as a complete reference supplementing the present publication.

THE FEDERAL ELECTRIC CO., Chicago, Ill., is sending out the May issue of *The Federalist*, which contains descriptions of Federal tungsten clusters, street hoods and various fittings written in the usual interesting style. A folder inserted in this number points out the advantages of Westinghouse fans.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., especially mention its ceiling fans in the May number of *The Emerson Monthly*, which has just been mailed. The announcement is made in this issue that Emerson bulletins will hereafter be put out in book-bound form to provide for easy reference.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, St. Paul, Minn., announces that the Globe Brand rubber-covered wire, which complies fully with the requirements of the Board of Underwriters, will be supplied from the company's St. Paul stock. The prices are but little higher than those asked by makers of inferior wire.

THE ROBBINS & MYERS COMPANY, Springfield, O., recently distributed Booklet No. 96 in which are described the more important styles of Robbins & Myers "Standard" fans. Tables included give the sizes, voltage, finish and other information useful to the prospective buyer. The company will mail the booklet free to those interested.

THE CHICAGO PORTLAND CEMENT COMPANY, Chicago, Ill., describes in a recent booklet the maunfacture of "Chicago AA" Portland cement. Photographs are reproduced to show not only the methods of manufacture, and scenes in the factory, but some of the plant buildings which are constructed of reinforced concrete made with "Chicago AA" Portland cement. Motor drive is used in the mills.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., is distributing an attractive mailing card setting forth the advantages of three-wire direct-current generators, which the company is now prepared to supply for practically any capacity. The neutral in their machines is obtained from an additional generating winding in the armature, which is connected to a single collector ring. Efficiency, great overload capacity and simplicity are some of its features.

MORRISON & COMPANY, Valparaiso, Chile, announce that they are establishing an American office in New York City and will in addition to plumbing supplies, etc., be in the market for wholesale electrical supplies. At present Louis I. Munoz and Ramon Vidal, of the company, are making their headquarters with

the Goulds Manufacturing Company, 16 Murray Street, New York City, and will do so until the branch is established. The representatives of the company wish to communicate direct with manufacturers of electrical supplies and apparatus.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., on the occasion of its organization dinner at Milwaukee on February 24, tendered a unique entertainment to its staff in the form of a stereopticon presentation of life-like characteristics of the leading men of the organization. The leading spirit in the preparation of this entertainment, Charles L. Benjamin, advertising manager of the company, has reproduced the entertainment in full and it is now being distributed in handsome bulletin form as one of the special publications of the company.

THE RICHARDSON ENGINEERING & MANUFACTURING COMPANY, Hartford, Conn., is listing isolated lighting plants covering a wide range of sizes in its new catalog now ready for distribution. The plants are sold complete, the equipment including gasoline and kerosene engine, generator, switchboard, storage battery and tungsten-filament lamps with all wire and fittings necessary to install. The plants range in size from the ten-lamp, eight-volt for camps, small cottages, etc., to the 330-lamp, fifty-seven-volt size. The catalog contains descriptions of all of the various parts and also lists vacuum cleaners and farm pumps to be used in connection with the plants.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a number of bulletins on electrical apparatus and supplies, and is distributing them to the trade. One of these, entitled "Charging the 'Electric' at Home" describes the company's mercury-arc rectifier as used for charging the batteries of electric runabouts. Bulletin No. 4799 deals with several types of revolving-field alternators with both horizontal and vertical shafts. A number of these are illustrated. Curve-drawing ammeters, types "CR" and "CR-2" are described and illustrated in Bulletin No. 4820. In Bulletin No. 4816 is described a new running-light telltale board placed upon the market by this company, which has the approval of the Underwriters' Laboratories, and affords a reliable means of indicating whether or not the running lanterns on a vessel are lighted. The board may be located in the pilot house of the boat, and is so arranged that both an audible and visible warning is given on the failure of any of the lamps.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., has just received from the printers its bulletins No. 121 and 122 which it is distributing. The first of these reprints a paper on the development and application of central-station heating, from the proceedings of the third annual convention of the Pennsylvania Electric Association. The author calls attention to the fact that nearly four hundred city plants are supplying steam for heating through a system of underground mains. He takes up the principles of construction and some of the advantages of the atmospheric system of heating. In this system steam is supplied to a hot water type of radiator through a specially constructed valve known as the "Adsco" graduated radiator valve. A diagram is included showing the interior piping arrangements. The second publication is a reprint from the proceedings of the seventeenth annual convention of the American Society of Municipal Improvements of a paper by Charles R. Bishop on district steam heating plants. Mention is made especially of the method of insulation of underground steam pipes and cross-section illustration is shown of the "Standard" stave casing. The value of keeping frequent readings of temperature, humidity, etc., is touched upon, as is also the advisability of making comparisons with the records of similar plants.

DATES AHEAD.

National Fire Protection Association. Annual meeting, New York, N. Y., May 23-25.

American Foundrymen's Association, American Brass Founders' Association and the Associated Foundry Foremen. Annual convention, Pittsburg, Pa., May 23-26.

American Society of Mechanical Engineers. Spring meeting, Pittsburg, Pa., May 30 to June 2.

National Electric Light Association. Annual convention, New York City, May 29 to June 3.

Commercial Section, National Electric Light Association, Meeting and banquet, New York, N. Y., June 1.

National District Heating Association. Annual meeting, Pittsburg, Pa., June 6-8.

Association of Railway Electrical Engineers, Semi-annual convention, Washington Terminal Station, Washington, D. C., June 16 and 17.

Association of Railway Telegraph Superintendents. Annual meeting, Boston, Mass., June 19-23.

Michigan Electric Association. Annual convention, on board steamer *Minnesota*, leaving Grand Haven, Mich., June 19, returning to St. Joseph, Mich., June 22.

Mississippi Electric Association. Annual convention Gulfport, Miss., June 20-21.

American Institute of Chemical Engineers. Semi-annual meeting, Chicago, Ill., June 21 to 24.

Society for the Promotion of Engineering Education. Annual meeting, Pittsburg, Pa., June 26, 27 and 28.

American Institute of Electrical Engineers. Annual convention, Chicago, Ill., June 26-30.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 27 to July 1.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 25-28.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 9 to 13.

Association of Railway Electrical Engineers. Annual convention La Salle Hotel, Chicago, November 6-10.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) May 9, 1911.

991,475. MANUFACTURE OF ELECTRODES FOR ARC LAMPS. André Blondel and Gaëtan Dobkevitch, Paris, France, assignors to General Electric Co. Filed Oct. 15, 1903. The electrode contains ninety-five to eighty per cent of a light-giving substance and five to ten per cent each of borate of barium and a borate of an alkali metal.

991,480. OIL-SWITCH. Christen Christensen, Scotia, N. Y., assignor to General Electric Co. Filed June 3, 1907. The contacts are first separated so as to draw the arc out horizontally, then a barrier is moved into the arc stream to break it.

991,481. CURRENT-CONTROLLING DEVICE. Allan J. Cline, Chicago, Ill. Filed July 8, 1909. A resistance-controlling switch has a shaft reciprocating between two solenoids and carrying a cross-head contactor over a double set of contacts similar to those of an end-cell switch.

991,483. PROTECTIVE DEVICE. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Co. Filed Sept. 18, 1907. A lightning arrester has two spark gaps between each conductor and ground and means for forcing oil through one gap in one direction and through the other gap in the other direction.

991,488. INSULATED RAIL-JOINT. William L. De Remer, Chicago, Ill. Filed Sept. 28, 1908. Has insulating sheets between the rail ends and between each rail on one side and the sectional combined fish and base plate.

991,490. COMBINED TIMER AND DISTRIBUTER-MAGNETO. Willard E. Dow, Braintree, Mass. Filed Oct. 18, 1909. Has a timing ring on the magneto to co-operate with a contact lever and distributer.

991,495. ARC-LAMP. Heinrich Friedrichsen, Berlin, Germany, assignor to General Electric Co. Filed July 10, 1908. Relates to the arc-striking plates for a flaming-arc lamp with converging electrodes.

991,500. AIR-BRAKE SYSTEM. Frank Goff, Camden, N. J. Filed July 1, 1910. Has solenoid-controlled application and release valves, the stems of the valves constituting the cores of the solenoids.

991,502. KNIFE-SWITCH. James J. Hartley, Schenectady, N. Y., assignor to General Electric Co. Filed July 5, 1904. The pivot pin of a knife-blade switch has a split shank and a circumferential groove engaging a spring washer.

991,508. COAL-MINING MACHINE. Elmer Hough, Wellsburg, W. Va. Filed Mar. 11, 1910. On the extended shaft of a motor are oppositely disposed coal-cutting disks.

991,511. CIRCUIT-BREAKER. Edwin Johnson, Schenectady, N. Y., assignor to General Electric Co. Filed Aug. 21, 1907. A laminated-contact circuit-breaker operated through solenoid-controlled release of a toggle mechanism.

991,538. FLUID-PRESSURE BRAKE. Walter Phillips, London, England, assignor to Westinghouse Air Brake Co., Pittsburg, Pa. Filed Aug. 5, 1905. Combined with an electric generator adapted to be driven from the car axle for controlling the brake-cylinder pressure are means normally preventing the operation of the generator but causing it to operate when the brakes are applied.

991,546. CIRCUIT-BREAKER. Walter S. Ryan, Muncie, Ind. Filed Sept. 12, 1908. Connected to the core of a solenoid is an operating bar for releasing a clutch that holds the switch closed. A scale and indicator permit adjustment of the opening current.

991,556. HIGH AND LOW-POTENTIAL SELECTIVE SWITCH SYSTEM. Ray Stearns, Schenectady, N. Y., assignor to General Electric Co. Filed July 26, 1910. A duplex switch for an electric car permits the car circuits to be connected to either a high-potential or low-potential source but not to both at the same time.

991,578. INCANDESCENT ELECTRIC LAMP. Willis R. Whitney, Schenectady, N. Y., assignor to General Electric Co. Filed August 19, 1907. Renewed Sept. 23, 1910. A V-shaped tungs-

ten filament is held in tension by a compressed spiral carbon spring inclosed in a glass cap attached to the stem.

991,583. BELL DESK INSTRUMENT. Charles L. Williams, Parkersburg, W. Va. Filed August 5, 1910. A desk telephone has a laterally extending bracket, a series of toggle levers connected with it, circuit-making and breaking devices operated by the toggle levers and a rotary receiver holder connected with these levers.

991,590. ELECTRICAL SWITCH. Joseph L. Wright, Washington, D. C., assignor to North Electric Co., Cleveland, Ohio. Filed April 20, 1907. A selective calling switch for the automanual telephone system has ten keys in a row. Depression of any key closes its circuit and releases any previously depressed key.

991,621. ACETYLENE-GENERATOR. Ludwig Janecek, Fremont, Neb., assignor of one-half to Frank Dolezal, Fremont, Neb. Filed Nov. 18, 1908. When water fills either of two carbide compartments it raises a float, closes an electric circuit and rings an alarm.

991,626. INDUCTION-MOTOR. Charles E. Lord, Milwaukee, Wis., assignor to Allis-Chalmers Co. Filed Sept. 13, 1909. The rotor has a winding on its core and short-circuiting end rings partly inclosed in shells of iron.

991,634. AUTOMATIC CUT-OUT FOR ELECTRICAL CONDUCTORS. Maurice George Newbould, Napier, New Zealand. Filed June 19, 1908. On the car for a railway system with two trolley wires is a pair of shunt electromagnets independently connected to the respective wires. A polarized armature in common to both magnets is arranged to open a circuit-breaker in each supply lead when either main wire breaks.

991,654. TELEPHONE-EXCHANGE SYSTEM. Newton C. Schellenger, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Filed Feb. 14, 1901. Two pairs of relays associated with the cord circuit control supervisory lamps.

991,672. PRINTING-TELEGRAPH. George S. Tiffany, Summit, N. J., assignor to Bankers Trust Co. Filed Jan. 3, 1910. Includes a rotary type mechanism and an impression mechanism, the former being magnetically moved through a rotary selective magnetizable member.

991,684. CHAIN-GUIDE FOR ELECTRICAL-PULL-SOCKETS. David P. Wolhaupter, Washington, D. C. Filed Feb. 15, 1911. Combined with the outer casing and the inner switch body is a divided chain guide whose separate sections are carried respectively by the casing and the switch body.

991,685. PROCESS AND APPARATUS FOR PURIFYING ACID ELECTROLYTE USED IN REFINING COPPER. Charles H. Aldrich and John K. Bryan, Perth Amboy, N. J. Filed June 25, 1910. Consists in removing the greater portion of the contained copper by concentration and crystallization, concentrating the residue by successive stages to about seventy degrees Baumé, separating the electrolyte from the precipitate and finally separating the remaining metallic impurities from the electrolyte by electrolysis.

991,691. ELEVATOR-DOOR LOCK. John E. Boyce, New York, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Nov. 30, 1907. Locking of the door latch closes the circuit to the car controller so that the car cannot be moved while any door is open.

991,695. APPARATUS FOR ELECTROCHEMICAL TREATMENT OF ORES. Tullio Bubola, Luipaardsvlei, Transvaal. Filed Aug. 27, 1910. Combined with a circular vat for containing the ore and treating liquid is an electrode in the lower part of the vat, arms disposed above the vat, mechanism for imparting to the arms a planetary motion about the axis of the vat, and rod-like electrodes depending from the extremities of the arms into the vat.

991,726. SPLICE-BAR FOR ELECTRICALLY-WELDED JOINTS. Henry F. A. Kleinschmidt, Johnstown, Pa., assignor to Lorain Steel Co. Filed Sept. 14, 1908. A splice bar for electrically welded rails has three projections on one face thereof, each of the projections having two parallel contact faces thereon disposed in different planes.

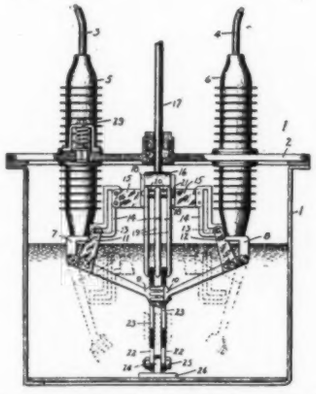
991,729. PORTABLE HEATER. Oliver C. Knipe, Palo Alto, Cal., assignor to Alf. Harris, Merced, Cal. Filed Oct. 17, 1908. Consists of a number of heating elements, each composed of a flat body about which is the heating coil, which is covered by an insulating layer.

991,749. LIGHTNING-ARRESTER. Alfonso R. Rheinberger, St. Paul, Minn. Filed March 29, 1909. Mounted on an insulator pin are two superposed conical electrode shells insulated from each other. One is connected to ground and the other to the line, the regular line insulator being mounted on top of the upper shell.

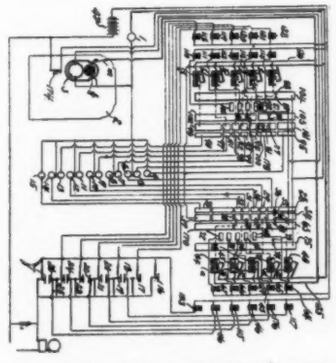
991,760. APPARATUS FOR TREATING LIQUIDS ELECTROLYTICALLY. Alfred O. Tate, Toronto, Ontario, Canada. Filed July 3, 1907. An electrode for an electrolytic cell embracing vertically disposed anodes and cathodes separated from each other by insulating material and provided with vertically disposed gas-conducting channels located on both faces thereof.

991,761. LAMP-SOCKET. William C. Tregoning, Cleveland, Ohio, assignor to Tregoning Electric Manufacturing Co., Cleveland, Ohio. Filed Feb. 20, 1909. A socket for sign lamps has a slot on one side for receiving a lamp-cord connection to an adjoining lamp.

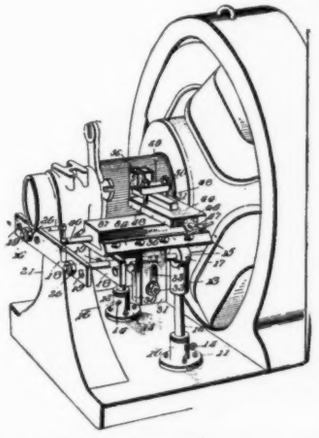
991,762 and 991,763. SHADE-HOLDER FOR ELECTRIC LAMPS. William C. Tregoning, Cleveland, Ohio, assignor to Tregoning Electric Manufacturing Co., Cleveland, Ohio. Filed April 8, 1909. Consists of a tubular body of spring material split longitudinally into several sections hinged together between their ends and adapted to clamp a socket at the top and a shade at the bottom.



991,480.—DOUBLE-POLE OIL SWITCH.



991,854.—ELEVATOR LAMP-SIGNAL SYSTEM.



991,996.—COMMUTATOR-TRUING MACHINE.

991,767. APPARATUS FOR PRODUCING OZONE. Charles G. Armstrong, Orange, N. J. Filed May 15, 1909. A number of condensers with narrow plates separated by solid dielectrics are arranged side by side to admit passage of air between them.

991,787. DYNAMO-ELECTRIC MACHINE. William Bennett Kouwenhoven and George B. Wilkins, New York, N. Y. Filed June 8, 1910. A direct-current shunt-field motor has its armature protected by having a choke coil in series with it.

991,829. ELECTRICAL RELAY. Edward E. Clement, Washington, D. C., assignor to North Electric Co., Cleveland, Ohio. Filed June 6, 1906. Combined with an electromagnet comprising two spools and pole pieces is a yoke adapted to engage the pole pieces to hold them against the core, together with an armature, and contact springs operated therethrough by the pole pieces.

991,837. WIRELESS SIGNALING SYSTEM. Simon Eisenstein, Berlin, Germany. Filed August 25, 1905. Associated with an antenna having an earth plate and inductance in its circuit are a number of secondary circuits shunted around the inductance and each having therein an adjustable spark-gap and a condenser, a number of transformers, the secondary coils of each shunted around each of the condensers respectively, and conductors to connect one terminal of the primary of each transformer to a collector ring of a polyphase generator whereby different discharges are caused to take place at the spark-gaps for each phase, the other terminus of the primaries being connected to each other.

991,841. RESISTANCE COMPOUND. William E. Gardner, Pitts-

burg, Pa. Filed Oct. 6, 1910. Consists of lamp black, bone ash, and flour of mica.

991,843. ENGINE-INDICATOR. James F. Gill, Bootle, near Liverpool, England. Filed March 11, 1909. Comprises normally broken electric circuits and means operated by the steam under pressure for closing the circuits and producing, by perforations made by this closing a diagram of the pressure during the operation of the engine.

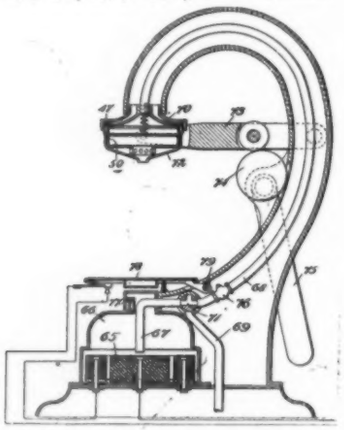
991,849. TRIPPING-DEVICE REGULATOR FOR ELECTRICAL SWITCHES. Philip Herd, Johannesburg, Transvaal. Filed Sept. 4, 1909. Consists of a tripping coil and tripping armature of a circuit-breaker and means for adjusting the weight on a loaded lever for retarding the armature.

991,853. ELECTRIC-CIRCUIT CLOSER. John Alexander Kennedy-McGregor, Birmingham, England, assignor of one-half to Edward William Bonson, Knowle, England. Filed April 2, 1910. The handle of a motor starter is normally connected to the contact arm but disconnected therefrom when an attempt is made to throw it to full-speed position too rapidly, a dashpot regulating the connection.

991,854. PILOT-LIGHT SYSTEM FOR ELEVATORS. Paul T. Kenny, New York, N. Y. Filed August 1, 1908. A signaling system has "up" and "down" buttons on each floor operating a lamp signal in the first car going in the desired direction.

991,860. INK-DRIER AND STATIC CHARGE REDUCER FOR PRESSES. Maurice L. Lane, Detroit, Mich., assignor of one-half to Claud S. Gordon, Detroit, Mich. Filed April 8, 1910. Consists of a tubular core with an electric heating coil wound upon it.

991,872. LOCKING ATTACHMENT FOR INCANDESCENT ELECTRIC LAMPS. Albert F. W. Meyer, Chicago, Ill., assignor to



992,021.—ELECTRIC TEA POT.

James H. McGill, Valparaiso, Ind. Filed May 11, 1908. A sectional wire guard about the lamp has a split collar for engaging the socket and locking it.

991,877. ELECTRICAL LIQUID-HEATER. Andrew P. Nichols, Seattle, Wash., assignor to Central Manufacturing Co., Seattle, Wash. Filed Jan. 13, 1910. Consists of a superposed series of conducting plates within a casing, alternate plates being connected to opposite sides of a circuit.

991,897. POSITIVE PLATE FOR STORAGE BATTERIES AND PROCESS FOR THE MANUFACTURE THEREOF. Pedro G. Salom, Philadelphia, Pa., assignor to Commonwealth Title Insurance & Trust Co., Philadelphia, Pa. Filed July 27, 1909. Consists in initially "forming" a mass of peroxide of lead obtained in the condition of definite particles, adding litharge thereto in about the proportions specified, moistening the mass until it has about the temper of molding sand, and compressing it upon a conducting support.

991,903. FIRE-ALARM. Frank Simonyi, New York, N. Y. Filed July 21, 1910. Rotation of a vane by a draft of heated air closes an electric alarm circuit.

991,912. LIGHTNING-ARRESTER. Eugene W. Vogel, Chicago, Ill., assignor to Railroad Supply Company, Chicago, Ill. Filed June 8, 1908. A ground terminal has a number of superposed annular plates surrounding it, some of the plates being made of aluminum and others of another good conducting material, and the aluminum plates alternating with the other plates.

991,928. TELEPHONIC RELAY SYSTEM. Charles G. Ashley, Chicago, Ill. Filed July 24, 1909. Includes a generator one of whose fields receives the telephonic current, the inductor stepping up its potential through a transformer.

991,929. FURNACE. Thaddeus F. Baily, Alliance, Ohio, assignor to Electric Furnace Co., Alliance, Ohio. Filed June 15 1910. Consists of two adjoining chambers one heated by gas and the other electrically.

991,957. TROLLEY-POLE ATTACHMENT. Frank Harry Crane, Cleveland, Ohio. Filed Nov. 23, 1910. A cylindrical casing on the pole top contains two brackets, one for supporting the conductor and the other a spring for receiving the end of the conductor.

991,973. ELEVATOR SIGNALING APPARATUS. James M. Graham, New York, N. Y., assignor to Elevator Supply & Repair Co. Filed Feb. 25, 1908. Permits the operator in a car passing the floor to cause the signals to be displayed until the next car arrives at the floor.

991,996. TRUING-MACHINE. Osman E. Hunt, Eagle Grove, Iowa. Filed Aug. 19, 1910. Consists of an adjustable tool-holder for use in truing the commutator of a dynamo or motor.

992,001. PULL-KNOB FOR LIGHTING-CHAINS. George A. King, Waterbury, Conn., assignor to Scovill Manufacturing Co., Waterbury, Conn. Filed Feb. 7, 1911. The opening in the lamp socket has spring fingers for preventing a too free movement of the pull chain.

992,009. WATERPROOF SWITCH. Daniel McLellan Lang, Corry, Pa. Filed Nov. 2, 1909. Has a closed casing about the knife switch, with a pocket in the front cover for receiving the switch handle.

992,010. GRAPHIC RECORDING INSTRUMENT. Robert C. Lanphier, Springfield, Ill., assignor to Sangamo Electric Co., Springfield, Ill. Filed Nov. 9, 1910. A pair of motor elements is adapted to be independently operated by electric currents. Each has a shaft, an arm projecting from the shaft, a link connection between the arms, and a recording pen suspended from the link connection.

992,021. ELECTRICALLY-HEATED VESSEL. Manlio Marzetti, Milan, Italy. Filed Dec. 2, 1909. Combined with a vessel containing water to be heated is an insulating disk on the bottom of the vessel, and two electrodes of graphitic carbon in the form of coaxial cylinders resting thereon, a receptacle containing the tea to be infused, and a pipe leading from the inside of the vessel to convey the boiling water to the receptacle.

992,035. TROLLEY-SWITCH. Carl P. Nachod, Philadelphia, Pa. Filed May 21, 1910. Includes a flexible laterally yielding contact strip.

992,042. WIRELESS TELEGRAPHIC APPARATUS. Michael A. Parisano, New York, N. Y. Filed May 27, 1910. The combination of an antenna consisting of a continuous wire and comprising a plurality of loops, perforated supports through which the loops are threaded, a number of sockets, a number of connections between the loops and sockets joined to the wire at varying distances from its end, and a connecting plug adapted to fit the sockets.

992,077. PUSH-BUTTON SWITCH. Edwin D. Stalfort, Baltimore, Md. Filed Sept. 14, 1910. Has a metal ratchet wheel with alternate teeth of insulating material so that alternate depressions of the button open and close the circuit.

992,084. INCANDESCENT-LAMP LOCK. Charles W. Trulock, Los Angeles, Cal. Filed June 30, 1909. A combination plug and socket comprises a screw-threaded plug having a central terminal, and a screw-threaded socket having a central terminal, the socket being partly concealed within the plug and rotatably carried thereby.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired May 15, 1911:

519,715. HAND REGULATOR OR SWITCH FOR MOTORS. Emil E. Keller, Chicago, Ill.

519,726. ELECTRIC-ARC LAMP. Wilhelm Mathiesen, Leipsic, Germany.

519,794. ELECTRIC-RAILWAY SYSTEM. David Mason, Schenectady, N. Y.

519,813. ELECTRICALLY-GOVERNED SWITCH. Emil H. E. Klatte, Freiburg, Baden, Germany.

519,849. ALTERNATING-CURRENT ARC-LIGHTING SYSTEM. Thomas Spencer, Philadelphia, Pa.

519,858. CONSTANT-CURRENT DYNAMO. William H. Elkins, Cambridge, Mass.

519,862. METHOD OF AND MEANS FOR STARTING SYNCHRONOUS MOTORS. Benjamin G. Lamme, Pittsburg, Pa.

519,869. ELECTRIC MECHANISM FOR GIVING RECIPROCATING MOTION. Henry S. McKay, Boston, Mass.

519,870. MAGNETIC ENGINE FOR RECIPROCATING TOOLS. Henry S. McKay, Boston, Mass.

519,876. TELEPHONE-CIRCUIT. Charles E. Scribner, Chicago, Ill.

519,881. DEVICE FOR REGULATING ELECTRICITY GENERATED BY MEANS OF WIND-POWER. Theodore A. Willard, Norwalk, Ohio.

519,912. ELECTRIC-ARC LAMP. Jesse F. Kester, Buffalo, N. Y.

519,932. ELECTRIC RAILWAY-SIGNAL. Rollin M. Strong and Charles F. Read, Omaha, Neb.

519,938. ELECTRIC RAILWAY-SIGNAL. Frank Beattie. Lette Island, Conn.

519,945. ELECTRIC INDICATOR. Wilburn E. Garey, Chicago, Ill.